FX-870/1170

SERVICE MANUAL

Revision Level	
Revision	**Date**
1st printing	10/1/92

EPSON®


Printed on Recycled Paper.

FCC Compliance Statement

For American Users

This equipment has been tested and found to comply with limits for a Class B digital device pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio or television reception. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from the one connected to the receiver.

For Canadian Users

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le present appareil numcrique n'cmet pas de bruits radkklectrique d&passant lea limites applicables aux appareils numcriques de Classe B prescrites dans le rkglement sur le brouillage radioGctriques tdictk par le Minis&e des Communications du Canada.

Warning

The connection of a non-shielded equipment interface cable to this equipment will invalidate the FCC Certification of this device and may cause interference levels which exceed the limits established by the FCC for this equipment. It is the responsibility of the user to obtain and use a shielded equipment interface cable with this device. If this equipment has more than one interface connector, do not leave the cables connected to unused interfaces.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Copyright Notice

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Precautions

Precautionary notations throughout the text are categorized relative to 1) personal injury, and 2) damage to equipment.

WARNING Signals a precaution which, if ignored, could result in serious or fatal personal injury. Great caution should be exercised in performing procedures preceded by a WARNING heading.

CAUTION Signals a precaution which, if ignored, could result in damage to equipment.

The precautionary measures itemized below should always be observed when performing repair/ maintenance procedures.

WARNING

1. Always disconnect the product from both the power source and the host computer before performing any maintenance or repair procedure.

2. No work should be performed on the unit by persons unfamiliar with basic safety measures as dictated for all electronics technicians in their line of work.

3. When performing testing as dictated within this manual, do not connect the unit to a power source until instructed to do so. When the power supply cable must be connected, use extreme caution in working on the power supply and other electronic components.

CAUTION

1. Repairs on Epson products should be performed only by an Epson certified repair technician.

2. Make certain that the source voltage is the same as the rated voltage listed on the serial number/rating plate. If the Epson product has a primary AC rating different from the available power source, do not connect it to the power source.

3. Always verify that the Epson product has been disconnected from the power source before removing or replacing printed circuit boards and/or individual chips.

4. In order to protect sensitive **µP** chip and circuitry, use static discharge equipment, such as anti-static wrist straps, when accessing internal components.

5. Replace malfunctioning components only with those components recommended by the manufacturer; introduction of second-source ICs or other nonapproved components may damage the product and void any applicable Epson warranty.

How to Use this Manual

This manual contains the information that a service provider needs to support the Epson FX-870/1170 printer.

- It provides general information and specifications for the printer.
- It tells you how to set up and configure the printer at a customer site.
- If you encounter problems, the manual explains how to troubleshoot the printer, based on the symptoms you are experiencing.
- Once you have isolated the problem, the manual shows you how to take the printer apart to remove any faulty component and replace it.
- Then, the text describes how to adjust the printer.
- The manual also provides a detailed discussion of the theory of operation.
- There are schematics, circuit diagrams, exploded diagrams, and an index at the back of the manual for quick reference.

The paragraphs below describe the contents of this manual in further detail.

1 Printer Features

Chapter 1 contains printer specifications, answers to a list of likely questions that customers may ask the servicer, an explanation and tables of control panel settings, and a brief description of the major printer components.

2 Installation and Setup Procedures

This section lists site requirements for the printer. It describes how to unpack the printer, connect it, power it up, and test it. The text describes the printer interfaces, and gives signal tables and serial cable configurations. Finally, this section tells you what the customer needs to do to avoid problems and achieve maximum printer life.

3 Troubleshooting

This section begins with quick reference tables for the printer's test points. The chapter also provides an explanation of what each error code means, flowcharts that walk you through the troubleshooting of various problems, an illustration of connector locations, and illustrations of sensor locations.

You can use the set of troubleshooting tables and flowcharts to isolate the problem as far as possible.

If you encounter problems using ***software,*** the ***Troubleshooting*** section lists supported Epson ESC/P control codes and symbol sets. There are tips for graphics handling and an explanation of how to read hex dump printouts.

4 Disassembly/Assembly

This chapter lists the tools you need and gives the recommended procedure for removing and replacing components.

5 Adjustments, Maintenance, and Lubrication

This chapter provides instructions for performing the platen gap adjustment and the bidirectional adjustment procedure. There is also a description of the lubricants required and an illustration of the points at which the printer needs to be lubricated after repair of the mechanism.

6 Principles of operation

The ***Principles of Operation*** section explains the theory **of** printer operation, including printhead function, carriage movement, paper feeding, and ***ribbon*** feeding. The chapter provides details about how printer components function mechanically and electronically. At the end of the chapter, there is a section for dealers outside the U.S. who need to replace individual components on the circuit boards.

7 Reference Materials

The Reference Materials section contains pin assignment tables, board layout diagrams, circuit diagrams, and schematics.

Index

The index tells you where to find key words **and** phrases in the manual.

Handy Numbers for U.S. Dealers

Epson Customer Resource Center	(800) 922-8911
Epson Faxback System	(310) 782-4214
Epson Bulletin Board System	(310) 782-4531

Numbers and Addresses for Dealers Outside the U.S.

Epson Canada, Ltd.
95 Mural Street
Richmond Hill, Ontario L4B 3G3
Phone: (800) GO-EPSON
Fax: (416) 881-5765

Epson Do Brazil
Av. Pedroso De Morais
631, 5th Floor
Pinheiros, Sao Paulo-SP/05419 Brazil
Phone: (55) (11) 813-3044
Fax: (55) (11) 210-9290

Epson Argentina S.A.
Avenida Del Libertador
498, Piso 12
1001 Buenos Aires
Phone: (541) 394-2439
Fax: (541) 322-4637

Epson Mexico S.A. De C.V.
Av. Ejercito Nacional No. 904
6 Piso Col. Palamas Polanco
Condigo Postal 11510, Mexico, D.F.
Phone: (525) 395-9944
Fax: (525) 395-9499

Epson Latin America, Inc.
6100 Blue Lagoon Drive
Floor 2, Suite 220
Miami FL 33126
Phone: (305) 265-0092
Fax: (305) 265-0097

Epson Chile S.A.
Avenida Costanera Andres Bello 2287
Providencia, Santiago, Chile
Phone: (562) 232-4661
Fax: (562) 233-3197

Epson Costa Rica
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San Jose, Costa Rica
Phone: (506) 34-6666
Fax: (506) 25-5709

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Edif. Epson - La Urbina
Caracas, Venezuela
Phone: (582) 241-0433
Fax: (582) 241-4561

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Chapter 1

Printer Features

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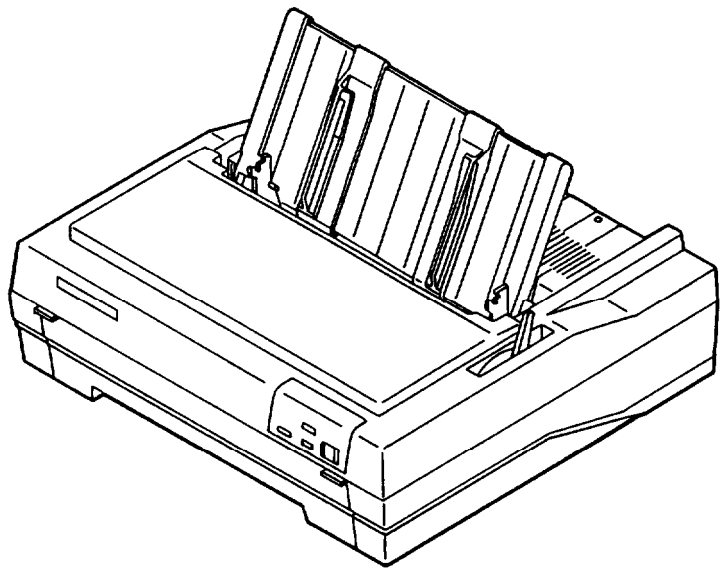
Printer Features 1

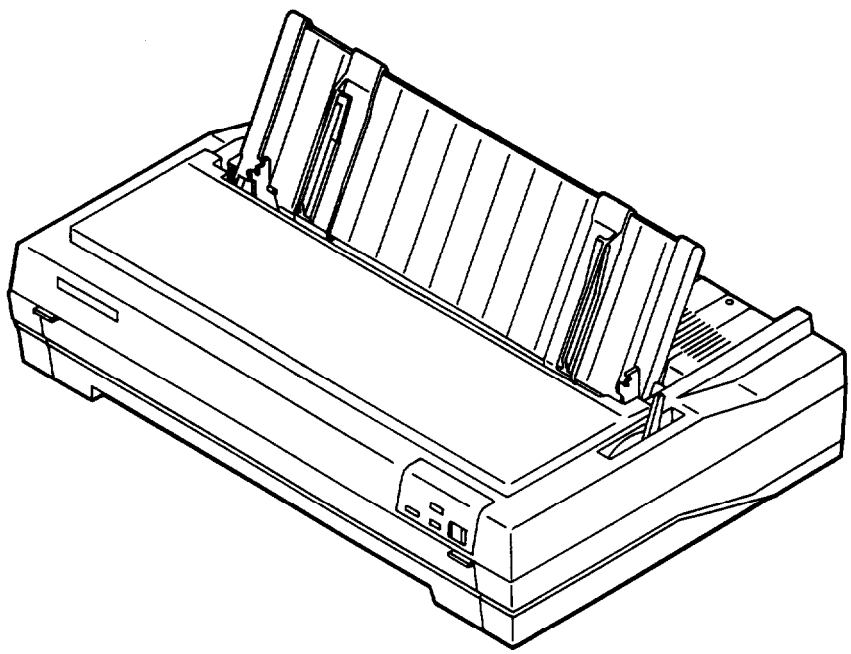
The FX-870/1170 combines advanced firmware, reliability, and affordability in a single light-weight unit. The major features of this printer are:

- Upward compatibility with the FX-850/1050 and the FX-86e/286e
- 380 cps (high-speed draft for both **80-** and **136-column** models)
- 285 cps (**draft** pica), 342 cps (**draft** elite)
- Advanced paper handling
  - Continuous paper
    - 3 paths for insertion (front/bottom/rear)
    - Dual paper park and auto load (front/rear)
    - The standard tractor unit can be set to 3 positions (2 push and 1 pull)
    - Continuous paper can be used without removing the cut-sheet feeder (CSF)
  - Cut sheets
    - 2 paths for insertion (top/optional front)
    - Auto loading
- 24KB input buffer
- 8 character tables
  (Italic, **PC437, 850, 860, 863, 865, BRASCII,** and Abicomp)
- A default setting mode replaces DIP switches for setting default values
- Type B optional I/F boards can be installed

Figure l-l on the next page shows an exterior view of the FX-870 and FX-1170.



80-column model



136-column model

Figure 1-1. External View of the FX-870/1170

options

C806371	Single-bin cut-sheet feeder (80-column)
C806391	Single-bin cut-sheet feeder (136-column)
C806381	High-capacity cut-sheet feeder (80-column)
C806401	High-capacity cut-sheet feeder (136-column)
C800201	Tractor unit (80-column)
C800211	Tractor unit (136-column)
C814001	Front sheet guide (80-column)
C814011	Front sheet guide (136-column)
C823051	Serial I/F card (Type B)
C823071	32KB intelligent serial I/F card (Type B)
C823101	32KB intelligent parallel I/F card (Type B)
C823141	Coax interface (Type B)
C823151	Twinax interface (Type B)
#8750	Fabric ribbon cartridge (80-column)
#8755	Fabric ribbon cartridge (136-column)
#8758	Fabric ribbon sub cartridge
#8310	Roll paper holder (only for 80-column model)

Hardware Specifications

Printing Method

Printing method: Impact dot matrix
Pin configuration: 9 wires (diameter 0.29 mm)

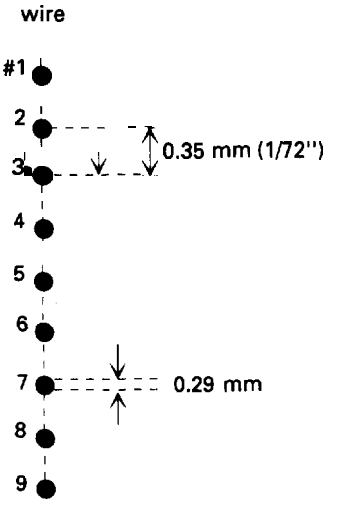


Figure 1-2. Pin Configuration

Dot matrix: 9 x 7 matrix (high-speed draft)
9 x 9 matrix (draft)
18 x 23 matrix (NLQ)

Paper Handling

Feeding methods: Friction feed (front/top)
Push tractor feed (front/rear)
pull tractor feed (front/rear/bottom)
Push-pull tractor feed (front/rear)

Method to use for each type of paper:

Fanfold:	Tractor feed
Cut sheets:	Friction feed
Envelopes:	Friction feed
Labels:	Tractor feed
Roll:	Friction feed

Line spacing: 1/6", 1/8", or programmable (1/216", minimum)

Table 1-1. Line Feed Speed (1 line = 1/6")

Type of paper	Single line feed		Continuous feeding	
	Thin ms	Thick ms	Thin ms (ips)	Thick ms (ips)
Fanfold paper	77	85	55 (3.0)	66 (2.5)
Single sheet (manual)	69	77	45 (3.7)	55 (3.0)
Cut sheet (CSF)	71	77	48 (3.5)	55 (3.0)

Thin: Thin paper is less than or equal to 0.007 inches (0.18 mm).
Thick: Thick paper is more than 0.007 inches (0.18 mm).

Precautions for Handling Paper

Friction feed

- Set the release lever to the FRICTION position.
- Load the paper from the front or top entrance.
- Do not use continuous paper.
- Do not perform any reverse paper feeds within the top 0.34” (8.5 mm) area and bottom 0.88” (22 mm) area.
- Do not perform reverse feeds greater than 1/6" after the paper end has been detected.
- Use the paper-tension unit.
- Insert multi-part cut-sheet forms only from the front.

Push tractor feed

- Set the release lever to the REAR PUSH/FRONT PUSH position.
- Load the paper from the rear or front entrance.
- Release the friction feed mechanism.
- Multi-part paper must be carbonless.
- Use the paper-tension unit.
- Do not perform reverse feeds greater than 1/6".
- Do not perform reverse feeding after the paper end has been detected, because accuracy of paper feed cannot be assured.

Pull tractor feed

- Set the release lever to the PULL position.
- Load the paper from the front, rear, or bottom entrance.
  (The front or bottom entrance is recommended for thick paper or labels.)
- Release the friction feed mechanism.
- Remove the paper-tension unit and attach the pull tractor unit.
- Insert paper from either front or bottom.
- Multi-part paper must be carbonless.
- Do not perform reverse feeds.

Push-pull tractor feed

- Set the release lever to the REAR PUSH/FRONT PUSH position.
- Load the paper from the front or rear entrance.
- . Release the friction feed mechanism.
- Remove the paper-tension unit and attach the pull tractor unit.
- Remove any slack in the paper between the platen and the pu11 tractor.
- Precisely adjust the horizontal position of the pull tractor and push tractor.
- Multi-part paper must be carbonless.
- Do not perform reverse feeds greater than l/6”.
- Do not perform reverse feeds after the paper end has been detected.

Paper Specifications

See Tables 1-2, 1-3, 1-4, 1-5, 1-6, and 1-7.

Normal Environmental Conditions

Recycled paper, envelopes, and labels require normal environmental conditions, which are the following:

Temperature:	59 - 68° F (15 - 25° C)
Humidity:	30 - 60 % RH

Table 1-2. Specifications for Cut Sheets (Standard Paper)

Width		
top insertion	5.8-l 0.1" (148-257 mm)	80-column
	5.8-l 6.5" (148-420 mm)	136-column
front insertion	7.2-10.1" (182-257 mm)	80-column
	7.2-14.3" (182-364 mm)	136-column
Length	Up to 14.3" (364 mm)	
Thickness	0.0025-0.0055" (0.065-0.14 mm)	
Weight	14-24 lb (45-78 kg) (52.3-90 g/m²)	
Quality	Standard copier paper Recycled paper (at normal temperature and humidity levels)	

Table 1-3. Specifications for Cut Sheets (Carbonless Duplicating Paper)

Width		
front insertion	7.2-10.1" (182-257 mm)	80-column
	7.2-l 4.3" (182-364 mm)	136-column
Length	Up to 11.7" (297 mm)	80-column
	Up to 14.3" (364 mm)	136-column
Quality	Carbonless duplicating paper	
Thickness	0.0047-0.0086" (0.12-0.22 mm)	
Weight	12-15 lb (34-50 kg) (40-58 g/m²) - each	
Copies	4 sheets (1 original + 3 copies) maximum	

Table 1-4. Specifications for Continuous Paper

Width	4-10" (101-254 mm)	80-column
	4-16" (101-406 mm)	136-column
Thickness	0.0025-0.012" (0.065-0.32 mm)	
Weight	14-22 lb (45-70 kg) (52.3-82 g/m²)	- single sheet
	12-15 lb (34-50 kg) (40-58.2 g/m²)	- each
Quality	Standard or carbonless duplicating paper Recycled paper (at normal temperature and humidity levels)	
Copies	4 sheets (1 original + 3 copies) maximum	

Table 1-5. Specifications for Envelopes

Size	No. 6	166 mm x 92 mm
	No. 10	240 mm x 104 mm
Thickness		0.16-0.52 mm (0.0063-0.0197") Differences in thickness within the printing area must be less than 0.0098" (0.25 mm).
Weight		12-24 lb (39-78 kg) (45-91 g/m²)
Quality		Bond paper, copier paper, airmail

Notes: 1. Envelopes must be inserted from the top.
2. Keep the longer side of the envelope horizontal during insertion.
3. Set the left edge of a No. 6 envelope at the sheet guide setting mark.
4. Do not feed envelopes with the standard-capacity cut-sheet feeder.

Table 1-6. Specifications for Labels

Size	2 1/2" x 15/16" 4" x 15/16" 4" x 17/16"	
Thickness	0.0028-0.0031" (0.07-0.09 mm)	- base paper
	0.0063-0.0075" (0.16-0.19 mm)	- total
Quality	Standard paper	

Notes: 1. Labels must be fanfold.
2. Example of labels: Avery continuous form or mini-line labels.
3. Labels should be used with the pull tractor (front, bottom) or the front push tractor.
4. Do not perform reverse feeds at any time (including by hand).
5. Remove labels from the paper path when not in use.
6. Label printing is possible only at normal temperature and humidity levels.

Table 1-7. Specifications for Roll Paper

Size	8.5 ± 0.12" (216 ± 3 mm)
Thickness	0.0028-0.0035" (0.07-0.09 mm)
Weight	14-22 lb (45-70 kg) (52.3-82 g/m²)
Quality	Standard paper

Note: Roll paper is available optionally only for the 80-column model, and its diameter must not exceed 5" (127 mm).

Printable Area

Cut sheets	top insertion	5.8-10.1" (148-257 mm):	80-column
		5.8-16.5" (148-420 mm):	136-column
	front insertion	7.2-10.1" (182-257 mm):	80-column
		7.2-14.3" (182-364 mm):	136-column

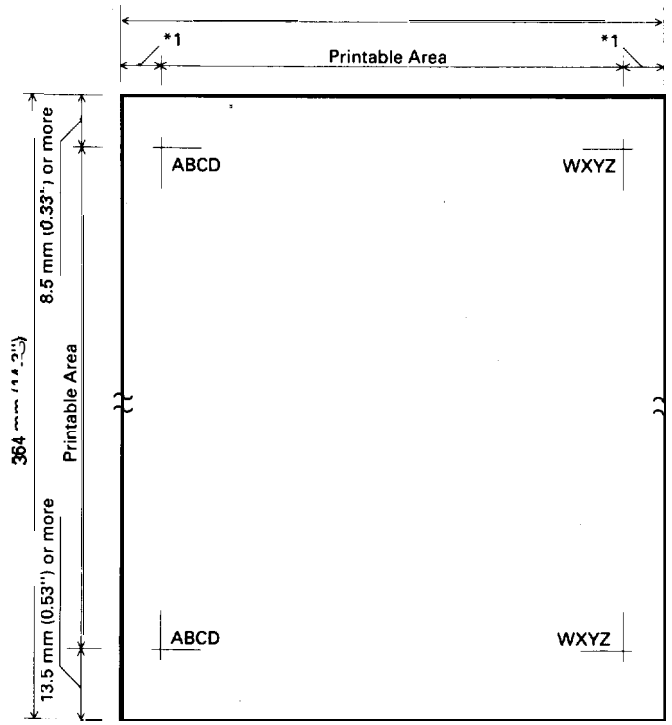


Figure 1-3. Printable Area for Cut Sheets

*1 0.12" (3.0 mm) or more when the paper width is less than 14.3' (364 mm).
0.9" (25 mm) or more when the paper width is 16.5" (420 mm) (136-column).
3.0 mm (0.12") or more (80-column).

Note: Paper feed accuracy cannot be assured within 0.94" (24 mm) from the bottom edge of the paper (for top insertion) or from within 1.9" (48.5 mm) from the bottom edge of the paper (for front insertion).

Continuous paper

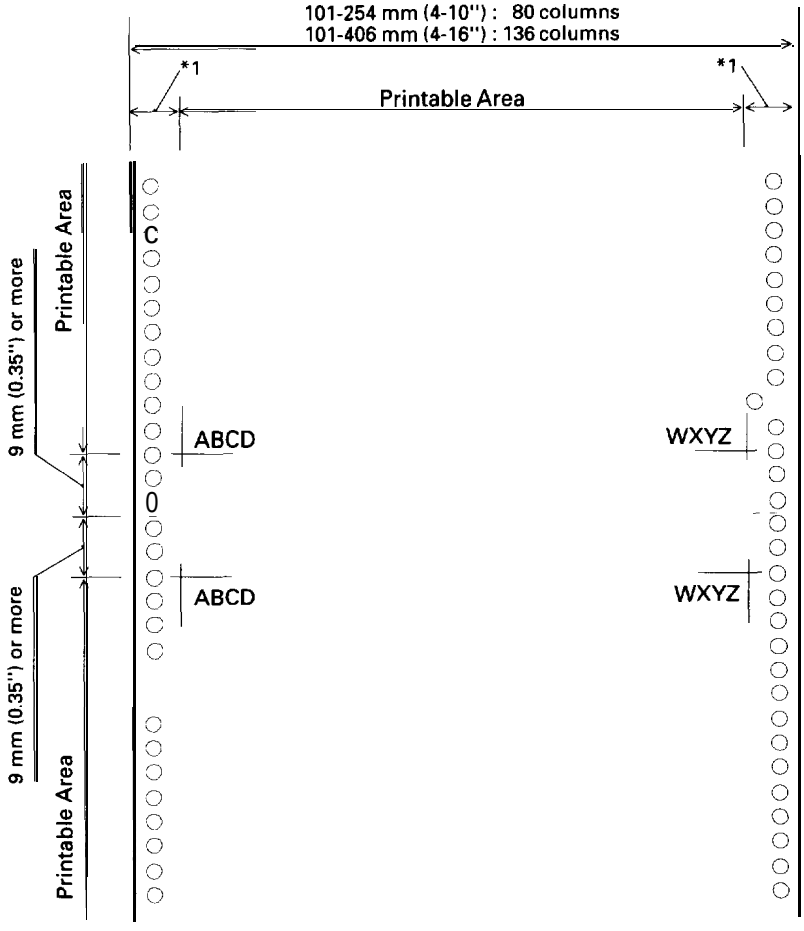


Figure 1-4. Printable Area for Continuous Paper

*1 13 mm (0.51") or more when the paper width is 4" to 9.5" (101 mm to 241 mm).
25 mm (1 .0") or more when the paper width is 10" (254 mm) (80 columns).
13 mm (0.51") or more when the paper width is 4" to 14.87" (101 mm to 377.8 mm).
25 mm or more when the paper width is 15" to 16" (381 mm to 406 mm)
(136 columns).

Roll paper (80-column model only)

top insertion	216 ± 3 mm (8.5 ± 0.12")

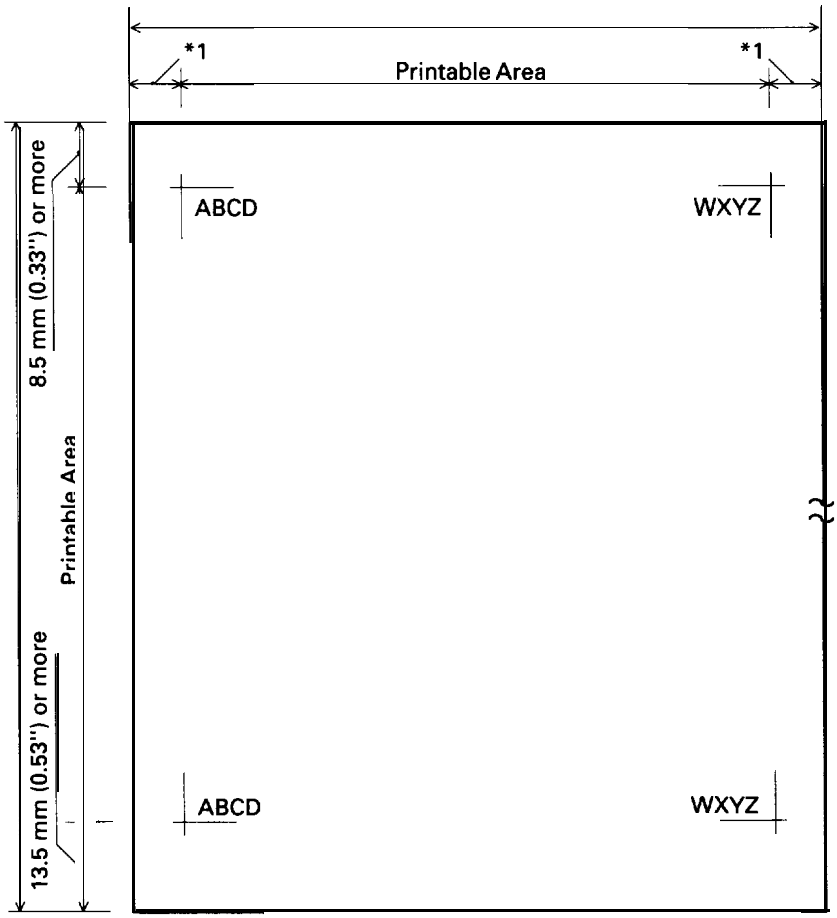


Figure 1-5. Printable Area for Roll Paper

*1 0.12" (3.0 mm) or more

Note: Paper feed accuracy cannot be assured within 24 mm (0.94") from the bottom edge of the paper (top insertion only).

Ribbon Cartridge

Ribbon	Cartridge type (same as FX series)	
	# 8750	80-column model
	# 8755(M)	136-column model
	# 8758	Subcartridge
Color	Black	
Ribbon Life	3 million characters (at 14 dots/character)	

Electrical Specifications

See Table l-8.

Table 1-8. Electrical Specifications for 120 V Model

Rated voltage	120 VAC
Input voltage range	103.5132 VAC
Rated frequency range	50-60 Hz
Input frequency range	49560.5 Hz
Rated current	1.8 A
Power consumption	Approx. 45 W (80 columns) Approx. 45 W (136 columns) (Self-test in draft mode, 10 cpi)
Dielectric strength	1.2K VAC rms, 1 second (Between AC line and chassis)

Environmental Conditions

Table 1-9. Environmental Conditions

Temperature	5 to 35° C (41 to 95° F) — operating -30 to 60° C (-22 to 140° F) — in shipment container
Humidity	10 to 80 % RH — operating 5 to 85 % RH — non-operating
Resistance to shock	1 G, within 1 ms — operating 2G, within 1 ms — non-operating
Resistance to vibration	0.25 G, 55 Hz max. — operating 0.50 G, 55 Hz max. — non-operating

Reliability

MCBF	5 million lines (excluding a printhead) (MCBF: Mean Cycles Between Failures)
MTBF (expected value)	4000 power on hours (duty cycle 25%) (80-column) 6000 power on hours (duty cycle 25%) (136-column) (MTBF: Mean Time Between Failures)
Printhead Life	100 million characters (14 dots/character)

Safety Approvals

Safety standards **UL1950** with D3
CSA22.2#220
RFI FCC class B

Firmware Specifications

Print Control

Printing direction
Text mode Bidirectional printing with logic seeking.
(Unidirectional printing can be specified by software.)
Bit image mode Unidirectional printing

Character sets ASCII characters

ESC/P mode — Italic, PC **437, 850, 860, 863,** 865, BRASCII, Abicomp
IBM mode — PC 473,865 (PC = Personal Computer character table)
Fonts: Draft, NLQ Roman, NLQ Sans serif

Table 1-10. Character Size and Pitch

Type of letters	Width [mm]	Height [mm]	Character pitch [mm]
Pica	2.1	3.1	2.54 (10 cpi)
Condensed	1.05	3.1	1.48 (17 cpi)
Elite	1.7	3.1	2.11‘ (12 cpi)
Condensed elite	0.85	3.1	1.27 (20 cpi)

Table 1-11. Printable Columns

Type of letters	Printable columns [cpl]	
	80-column model	136-column model
Pica	80	136
Condensed	137	233
Elite	96	163
Condensed elite	160	272

Table 1-12. Print Speed

Type of letters	Print speed [cps]
High-speed draft	380 (320) [142]
Draft pica	285 [142]
Draft elite	342 [170]
Condensed draft pica	243 [122]
Emphasized draft pica	142 [71]
NLQ normal pica	57

Notes:
1. The printing speed for high-speed draft is reduced to the value in "( )" with thick paper (over 0.007 inches or 0.18 mm).
2. The printing speed for high-speed draft is reduced to the value of "draft pica" when any graphic character is in the line.
3. The printing speed for draft is reduced to the value in "[ ]" when any italic character is in the line.
4. The speed for high-duty printing is reduced to approximately half of each speed, except for the printing speed in "[ ]".

Input Data Buffer

24K or OK bytes (selectable with power on default settings; ***see Power On Default Settings,*** later in this chapter.)

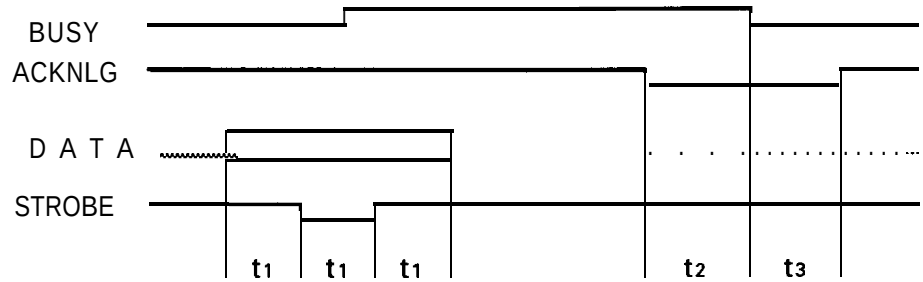
Interfaces

This printer has a built-in, 8-bit Centronics parallel interface.

Parallel Interface

Data transmission mode	8-bit parallel
Synchronization	Controlled by external $\overline{\text{STROBE}}$ pulse.
Handshaking	Controlled by $\overline{\text{ACKNLG}}$ and BUSY signals.
Logic level	TTL-compatible
Connector plug	57-30360 (Amphenol) or equivalent

It is recommended that the interface cable be as short as possible (10 feet or 3 meters, maximum).



t_1: 0.5 µs (minimum)
t_2: 7 µs (approximate)
t_3: 5 µs (approximate)

Figure 1-6. Data Transmission Timing

Table 1-13. Connector Pin Assignments and Signal Functions

Signal Pin No.	Return Pin No.	Signal Name	Dir.	Description
1	19	$\overline{\text{STROBE}}$	In	$\overline{\text{STROBE}}$ pulse to read data in. Pulse width must be more than 0.5 us at receiving terminal.
2	20	DATA 1	In	These signals represent the 1st to 8th bits of parallel data, respectively. Each signal is HIGH when data is a logical 1 and LOW when a logical 0.
3	21	DATA2	In	
4	22	DATA3	In	
5	23	DATA4	In	
6	24	DATA5	In	
7	25	DATA6	In	
8	26	DATA7	In	
9	27	DATA8	In	
10	28	$\overline{\text{ACKNLG}}$	out	Approx. 12 us pulse. LOW indicates that data has been received and that the printer is ready to accept more data.
11	29	BUSY	out	A HIGH signal indicates that the printer cannot receive more data. The signal becomes HIGH in the following cases: 1. During data entry 2. During input buffer full 3. During printer error status

Table 1-13. Connector Pin Assignments and Signal Functions (Cont.)

Signal Pin No.	Return Pin No.	Signal Name	Dir.	Description
12	30	PE	Out	A HIGH signal indicates that the printer is out of paper.
13	—	—	—	Pulled up to +5 V through a 3.3K-ohm resistor.
14	—	$\overline{\text{AUTO FEED XT}}$	In	When this signal is LOW, paper is automatically fed one line upon receipt of a CR code. (This signal level can be set LOW by default.)
15	—	NC	—	Not used.
16	—	0 V	—	Logic GND level.
17	—	CHASSIS GND	—	Printer chassis GND. In the printer, the chassis GND and the logic GND are short-circuited.
18	—	NC	—	Not used.
9 to 30	—	GND	—	Twisted-pair return signal GND level.
31	—	$\overline{\text{INIT}}$	In	When the level of this signal becomes LOW, the printer controller is reset to its initial state and the print buffer is cleared. This signal is normally at the HIGH level, and its pulse width must be more than 50 us at the receiving terminal.
32	—	$\overline{\text{ERROR}}$	Out	The level of this signal becomes LOW when the printer is in — 1. Paper-out status 2. Error status
33	—	GND	—	Twisted-pair return signal GND level.
34	—	NC	—	Not used.
35		--	-	Pulled up to +5V through a 3.3 K-ohm resistor.
36	—	$\overline{\text{SLCT IN}}$	In	The data between DC3 and DC1 is invalid when this signal is HIGH. (The level of this signal is factory set to LOW.)

Notes: 1. Direction of signal flow is as viewed from the printer.
2. Return means twisted pair return and is to be connected at signal ground level.
3. Be sure to use a twisted-pair cable for each signal, and always complete the connection on the return side. To prevent noise effectively, these cables

should be shielded and connected to the chassis of the host computer and the printer, respectively.

4. All interface conditions are based on TTL level. Both the rise and fall times of each signal must be less than 0.2 us.
5. Data transfers must not be carried out by ignoring the $\overline{\text{ACKNLG}}$ or BUSY signal. (Data transfers to this printer can be carried out only after confirming the $\overline{\text{ACKNLG}}$ signal or when the level of the BUSY signal is LOW.)

Optional Interfaces

The following interface cards can be used for this printer:

Table 1-14. Optional Interfaces

Catalog #	Interface
C823051	Serial I/F card (Type B)
C823071	32KB intelligent serial I/F card (Type B)
C823101	32KB intelligent parallel I/F card (Type B)
C823141	Coax interface (Type B)
C823151	Twinax interface (Type B)

Control Panel

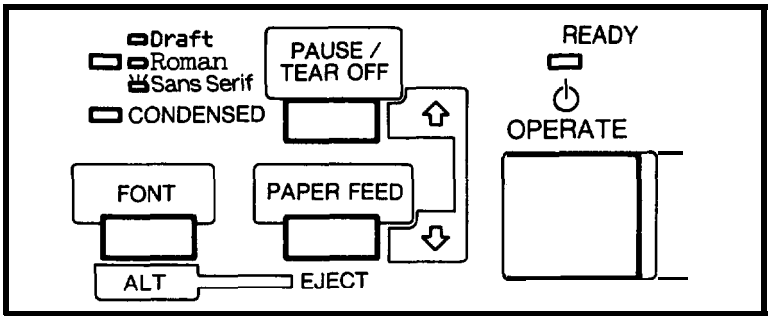


Figure 1-7. Control Panel

Buttons

OPERATE	1 lock type button
PAUSE/TEAR OFF PAPER FEED FONT	(non-lock push-type buttons)

Indicators — 3 LEDs

READY — (green)
FONT (Draft, Roman, Sans serif) — (green)
CONDENSED — (green)

Buttons

PAUSE

- When there is data in the input buffer:
  Selects printing or pause alternately.

- When there is no data in the input buffer:
  Advances continuous paper to tear-off position after the printer has printed all received data and is ready to receive more print data.

PAPER FEED

- When there is paper in the paper path:
  Advances the paper line by line, using the current line spacing setting while the printer is ready to print or paused by PAUSE button. Holding down the button for about 1 second advances the paper to the next top-of-form (TOF) position.

- When there is no paper in the paper path:
  Loads continuous paper inserted in the push tractor or cut sheets in the CSF after the printer has detected the paper out.

FONT (ALT)

Selects NLQ Roman, NLQ Sans serif, Draft, and condensed of those 3 fonts in rotation:

(Draft →	Draft cond. 3	Roman →	Roman cond. 3
Sans serif →	Sans cond. →	Draft →	Draft cond. . . .)

(The factory setting is Draft, uncondensed font.) The selection is executed when the button is released and is stored in non-volatile memory.

Micro Feed Function

- When paper is in the paper path:
  1. Press the PAUSE button to stop printing.
  2. Hold down the FONT (ALT) button and press the PAUSE button to enter the micro feed mode.
  3. The FONT and CONDENSED lights blink alternately to indicate that the printer is in micro feed mode.

- In micro feed mode:

  PAUSE
  Advances the paper forward by 2/216 inch per step.

  PAPER FEED
  Moves the paper backward by 2/216 inch per step.

Depending on the time when the micro feed is activated, it will micro-adjust the following positions:

- the loading position (immediately after paper is loaded in the printer).
- the tear-off position (when paper has been advanced for tear off).
- the current print position (this position is not stored in memory).

The adjustedloading and tear-off positions are stored in non-volatile memory (except for the position of cut sheets loaded by manual insertion). You can end micro feed mode by pressing the FONT button again. The printer exits this mode automatically when any data arrives from the host computer.

Bin Selection for the Cut Sheet Feeder

- When there is no paper in the paper path:
  Holding down the FONT (ALT) button while pressing PAUSE or PAPER FEED alternates bin selection if a double-bin cut-sheet feeder is attached and friction feed is selected.

Paper Ejection

Holding down the FONT (ALT) button and pressing PAPER FEED ejects a cut-sheet forward or feeds continuous paper backward to the paper park position.

Indicators

READY

Ready to print:	ON
Tear-off	Blinking (75% duty)
Pause:	Blinking (50% duty)
Paper error:	Blinking (25% duty)
Head hot:	Blinking (25% duty)

FONT

Draft:	OFF
NLQ Roman:	ON
NLQ Sans serif:	Blinking

CONDENSED

Normal pitch:	OFF
Condensed pitch:	ON

When an error occurs, the READY, FONT, and CONDENSED LEDs are used in combination to identify the error.

Table 1-15. Identification of Errors Using the LEDs

All indicators	Error
Blinking simultaneously	Fatal error
Blinking simultaneously very quickly	Incorrect RAM
Blinking sequentially in the clockwise direction	High voltage error
All on	Low vottage error
Blinking in the counter-clockwise direction	Head thermistor open circuit error

Default Settings

You can set certain default parameters to be used at printer initialization. To change the parameters shown in ***Table l-16, Group 1 Features,*** follow the steps below:

1. Turn on the printer while pressing the FONT button. The printer beeps once and prints the current default settings on the paper loaded in the paper path.

2. Press FONT to select a parameter. The FONT and CONDENSED **LEDs** turn on, off, or blink to show the current parameter selected. Press FONT as many times as necessary, until the **LEDs** indicate the setting to be changed. (See Table l-16.)

3. Press PAUSE to change the setting. The READY LED shows your selection.

4. Repeat this procedure for any Group 1 feature you want to change. (After you set the feature at the bottom of Table 1-16, the printer returns to the first feature in Table 1-16.)

5. When all the settings are as you want them, turn off the printer. The settings are stored in non-volatile memory.

Table 1-16. Group 1 Features

FONT LED	COND. LED	Feature	Setting	READY LED
OFF	ON	Emulation	ESC/P	OFF
			IBM Proprinter	ON
OFF	BLINKS	Character pitch	Pica	OFF
			Elite	ON
ON	OFF	Page length	11 inch	OFF
			12 inch	ON
			8.5 inch	BLINKS
			70/6 inch (A4)	BLINKS FAST
ON	BLINKS	Skip over perforation	No skip	OFF
			Skip 1 inch	ON
BLINKS	OFF	Zero face	0	OFF
			Ø	ON
BLINKS	ON	Auto tear-off	Valid	OFF
			Invalid	ON
BLINKS	BLINKS	Auto LF with CR	Depends on I/F	OFF
			Valid	ON

Note: The factory setting is that the READY LED is OFF for all features.

To change the settings shown in ***Table 1-17, Group 2 Features (ESC/P mode),*** or in ***Table l-18, Group 2 Features (IBM mode),*** follow the steps below:

1. Turn on the printer while pressing the FONT and PAUSE buttons. The printer beeps once and prints the current character table for either ESC/P or IBM mode on the paper loaded in the paper path.

2. Press the FONT button to select the character table. The FONT, CONDENSED, and BEADY LEDs turn on, off, or blink to show your selection. Press the FONT button as many times as necessary until the FONT, CONDENSED, and BEADY LEDs indicate the character set you want.

3. Turn off the printer. The settings are stored in non-volatile memory.

Table 1-17. Group 2 Features (ESC/P Mode)

FONT LED	COND. LED	READY LED	Character Table	
OFF	OFF	ON	Italic	U.S. (standard setting)
OFF	OFF	BLINKS		France
OFF	ON	OFF		Germany
OFF	ON	ON		U.K.
OFF	ON	BLINKS		Denmark
OFF	BLINKS	OFF		Sweden
OFF	BLINKS	ON		Italy
OFF	BLINKS	BLINKS		Spain
ON	OFF	OFF	Character table	PC437
ON	OFF	ON		PC850
ON	OFF	BLINKS		PC860
ON	ON	OFF		PC863
ON	ON	ON		PC865
ON	ON	BLINK		BRASCII
ON	BLINK	OFF		Abicomp

Note: When the character table PCxxx is selected, that is assigned as the table selected by the ESC tl command. Then ESC tl and ESC 6 are set as defaults. (Codes 80-9FH are printable characters.)

Table 1-18. Group 2 Features (IBM Mode)

FONT LED	COND. LED	READY LED	Character Table
OFF	OFF	ON	Character table PC437 (table 1) (standard)
OFF	OFF BLINKS		PC437 (table 2)
OFF	ON	OFF	PC865 (table 1)
OFF	ON	ON	PC865 (table 2)

Notes: 1. For table 1, codes 80-9FH are control codes. (ESC 7 is set.)
For table 2, codes 80-9FH are printable characters. (ESC 6 is set.)
2. The character tables for ESC/P mode and IBM mode are saved independently in non-volatile memory.

Power On Default Settings

The printer also lets you change some of its power on parameters. To change the settings shown ***in Table 1-19, Group 3 Features (Power On Settings),*** follow the steps below.

1. Turn on the printer while pressing the PAUSE and PAPER FEED buttons.
2. After a few seconds, press the buttons indicatedin Table 1-19 to change parameters.

Table 1-19. Group 3 Features (Power-on Settings)

Button	Feature	Betting
PAUSE	Input buffer	valid (• •) or invalid (•)
PAPER FEED	Draft printing speed	high (• •) or normal (•)
FONT	Auto CR	valid (• •) or invalid (•)

T
standard (factory) setting

Notes: 1. Auto CR moves the next print position to the left margin when a LF or the ESC J code is sent.
2. '•' is one beep, and '••' is two beeps. If no operation is executed within a few seconds, the printer exits the power on selection mode with five beeps (• • • • •). The selected value is stored in non-volatile memory.
3. The printer automatically becomes ready to print after the selection.

Self-Test

Press PAPER FEED while turning on the printer to put it in self-test mode. To stop the self-test, turn off the printer. (The control panel is still operational in self-test mode for paper handling and font selection.) When pages are printed from the cut-

sheet feeder (CSF), the first sheet is used for scaling the sheet length. Then, the maximum number of printable lines is printed in the bottom line of the sheet and saved in non-volatile memory as the default page length. Page lengths are saved individually when a dual-bin CSF is in use.

The self test prints out the following:

- Maximum printable lines (only on cut sheets from the CSF)
- Firmware version
- Current default settings
- Short help messages for control panel operation
- A pattern of characters, as shown below.

```
GAxxxxxx
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[¥]^_`abcdefgh
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[¥]^_`abcdefghi
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[¥]^_`abcdefghij
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[¥]^_`abcdefghijk
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[¥]^_`abcdefghijkl
                456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[¥]^_`abcdefghijklmn
```

Figure 1-8. Self-Test Printout

Hexadecimal Dump

Press the PAUSE button while turning on the printer to put it in hexadecimal dump mode. In this mode, the printer prints out the hexadecimal format for received data, along with the corresponding ASCII characters. This function is useful to check received data from the host. If a received code is not a printable ASCII character, the printer prints a period (.) in the ASCII column.

See Tables 3-10 and 3-11 for a hex listing of the commands acceptable to this printer.

```
Data Dump Mode
0000  1B 4B 1B 43 30 1B 4F 30 1B 54 31 34 0D 0A 1B 08   .K.C0.O0.T14....
0001  1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08   ................
0002  1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08   ................
0003  1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08   ................
0004  1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08   ................
```

Figure 1-9. Hexadecimal Dump Printout

Paper-out Detection

If the paper-out sensor detects a paper out, the printer automatically enters a pause condition after feeding or printing several lines. When a paper-out is detected, load new paper properly and set the printer ready to print by pressing the PAUSE button.

Auto Tear-off

When the release lever is set to one of the tractor positions, paper advances to the tear-off position automatically, if the input buffer is empty and paper is at the top-of-form position (as long as the printer receives no additional data after receiving a form feed). If it receives new data, the printer reverse feeds paper to its original position and starts printing. This function can be disabled in the default setting mode.

Buffer Full Printing

The printer stores received data in the input data buffer, and prints it when it encounters a print command (CR) or when the buffer becomes full.

Thermal Protection

When the thermistor detects that printhead temperature exceeds 180° F (82° C), the printer stops printing to protect the printhead from overheating.

High-Duty Printing

When the +35 V monitor circuit determines that printing duty is too heavy for the power supply because the line voltage has dropped, the printer stops printing until the voltage recovers. It then continues printing the rest of the document at halfspeed.

Sheet Loading and Sheet Ejection

The release lever engages or disengages the tractor unit drive mechanism. The lever's operation provides improved paper-handling functions:

- Automatic cut-sheet loading without the cut-sheet feeder

Move the release lever to the FRICTION position and load a sheet using the paper guide (top or optional front). A few seconds later, the sheet is automatically loaded to the top-of-form position, and the printer becomes ready to print.

. Automatic cut-sheet loading and ejection with the cut-sheet feeder

Move the release lever to the FRICTION position, and load a stack of paper into the cut-sheet feeder hopper. Pressing PAPER FEED loads the sheet to the top-of-form

position. If a paper out is detected before printing starts, the sheet is loaded automatically to the top-of-form position, without PAPER FEED being pressed.

- Continuous paper loading and ejection (paper park)

Move the release lever to REAR PUSH/FRONT PUSH position and load paper into the tractor unit. Press PAPER FEED to load the paper automatically to the top-of-form position. If a paper-out is detected before printing starts, paper is loaded automatically to the top-of-form position, without PAPER FEED being pressed.

If the FONT+PAPER FEED buttons are pressed when continuous paper is loaded, the paper is ejected backward to the paper park position. To feed several pages backward, repeat this operation several times.

Adjust Lever Operation

You must set the platen gap adjust lever to the proper position (from the 8 steps available) for the paper thickness. If this lever is set to position 2 (the 4th step) or higher, printing speed and paper feeding speed are reduced.

Table 1-20. Lever Positions

Lever Position	Paper Thickness
0 (2nd step)	0.0024 - 0.0048 inches (0.06 - 0.12 mm)
1 (3rd step)	0.0052 - 0.0068 inches (0.13 - 0.17 mm)
2 (4th step)	0.0072 - 0.01 inches (0.18 - 0.25 mm)
3 (5th step)	0.0104 - 0.0128 inches (0.26 - 0.32 mm)

Note: If printing density is light, set the platen gap adjust lever position one step closer.

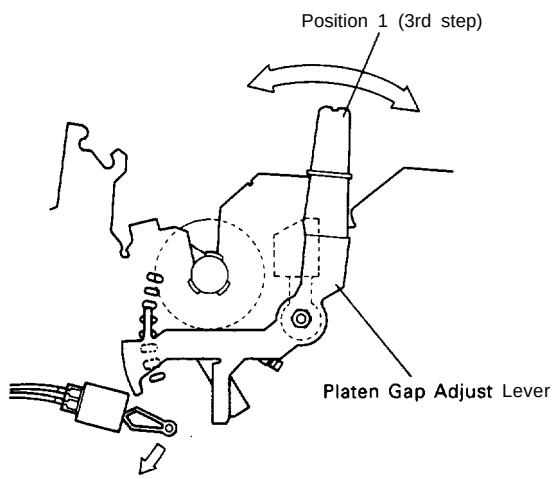


Figure 1-10. Lever Positions

Printer Initialization

The printer is initialized in the following cases.

- When the printer is turned on.
- When the INIT signal or CMREQ (optional I/F) is input.

When the printer is initialized, it performs the following functions:

- The printhead returns to the leftmost position (carriage home).
- The READY LED lights.
- The printer clears the print buffer and input data buffer.
- The line spacing is set to l/6 inch.
- The page length and skip-over-perforation settings are returned to their default values.
- All vertical tab positions are cleared.
- The horizontal tab positions are set to every 8 columns.
- The print mode is set to the default value set from the control panel and stored in non-volatile memory.

TOF position is reset in the following cases.

- Power on
- Receipt of the INIT signal or $\overline{\text{CMREQ}}$ (optional I/F)
- Receipt of a software reset command (ESC @)
- Receipt of a page length command (ESC C)

Note: The $\overline{\text{CMREQ}}$ signal goes LOW when the command request is sent from the optional card to the main system.

Buzzer

The buzzer beeps for 0.1 second at a time. These beep sounds are combined in various ways, as shown below, to indicate different meanings. In the following table, each " • " stands for one beep.

Table 1-21. Buzzer Functions

Status	Sound	Description
3EL code	•	Sounds when a BEL code is received.
Carriage trouble	••• •••	A carriage error has occurred.
Voltage error	No beeps.	(Indicators blink sequentially in the clockwise direction.)
Fatal error	No beeps.	(Indicators blink simultaneously.)
ncorrect memory	•• •• •• •• •• •• •• •• ••	— RAM — E²PROM
Paper error	•••• •••• •••• •••• ••••	Continuous paper has run out. Paper in the CSF has run out. Paper was not present at the start of a self-test. A sheet could not be ejected from the CSF.
	•••	Anotherpaperdetectionerroroccurred: With single-sheet feed selected, no paper is present. Continuous paper can't be loaded. Paper runs out after the PAPER FEED button is pressed.
Illegal paper release/unrelease	••••••••••••...	(continuously till corrected) The release lever was changed while there was paper in the paper path. Change the lever again or remove the paper in the path to stop the sound.
Recognition of operation	•	Power-on operation (self test, hex dump, default setting, or power-on) CSF bin -1 selected.
	••	CSF bin -2 selected.
Micro feed	·	The adjusted value set with micro feed is the same as the factory setting value (loading position or tear-off position).
	••••••••••••••...	(continuously until button is released) The micro feed value has reached its upper or lower limit.

Main Components

The components of the FX-870/1170 are designed for easy removal and replacement during maintenance and repair. The main components are:

- C094 MAIN board assembly
- C094 PNL board assembly
- C076 PSB board assembly
- Printer mechanism
- Housing assembly

The following figure shows the main components of the FX-870/1170.

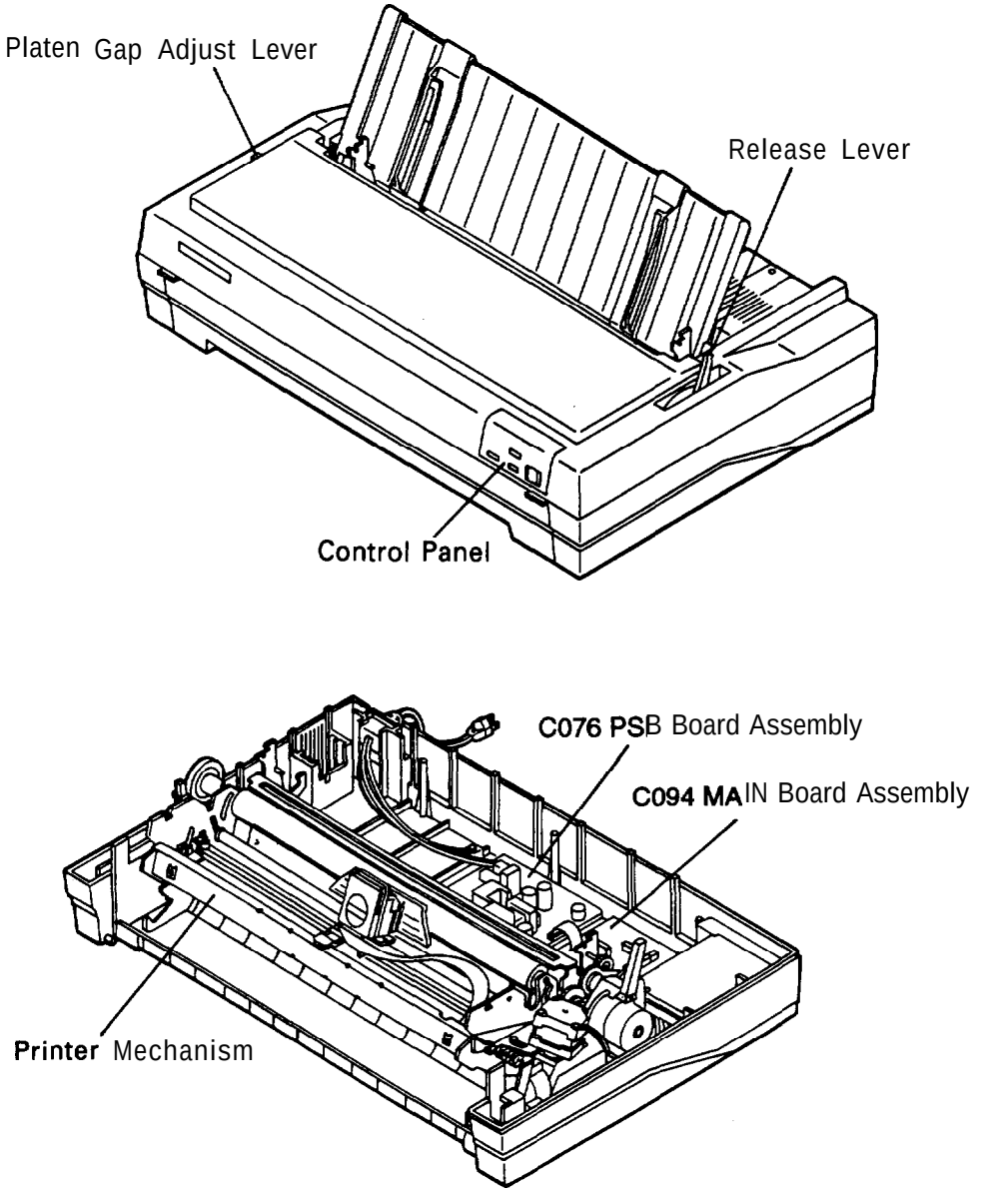


Figure 1-11. Main Components

C094 MAIN Board Assembly (Main Control Circuit Board)

Basically, the same board layout is used in both the 136-column model and the 80-column model. The CPU on this board controls all the main functions of the printer. It consists of a TMP90C041F 8-bit CPU, an E05A55YA gate array, an E²PROM, a PSRAM, a MASK ROM, motor drivers, and head drive transistors.

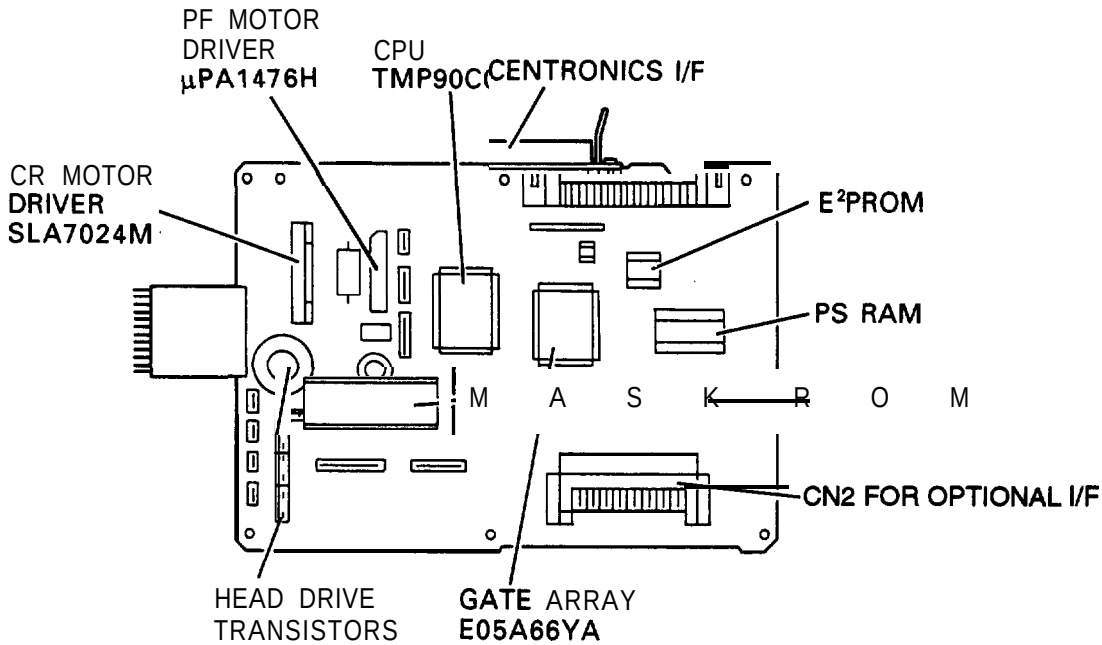


Figure 1-12. C094 MAIN Board Assembly (Main Control Circuit Board)

C094 PNL Board Assembly (Control Panel Circuit Board)

This board is the control panel of the FX-870/1170, consisting of a power button, three function buttons, and three indicator LEDs.

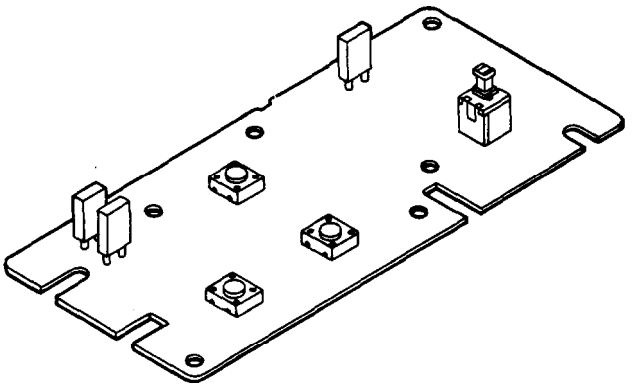


Figure 1-13. C094 PNL Board Assembly (Control Panel Circuit Board)

C076 PSB Board Assembly (Power Supply Circuit Board)

This board is composed of an input filter circuit, a transforming circuit, a switching regulator circuit, a rectifying circuit, a smoothing circuit, and various protecting circuits.

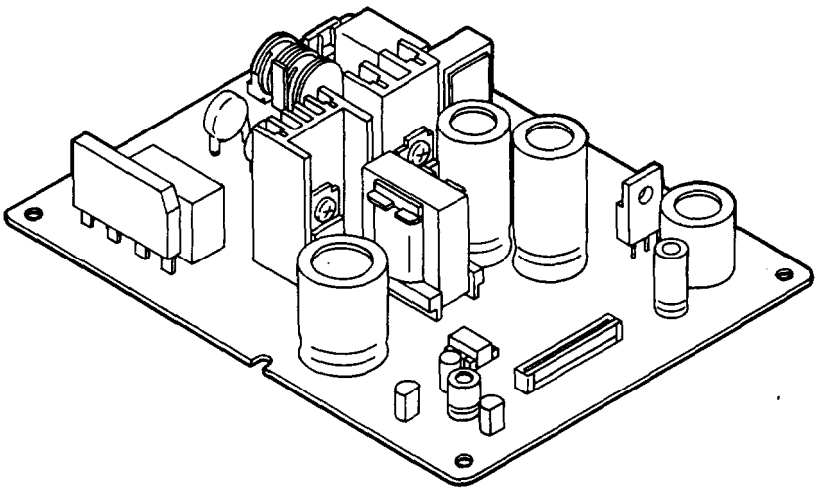
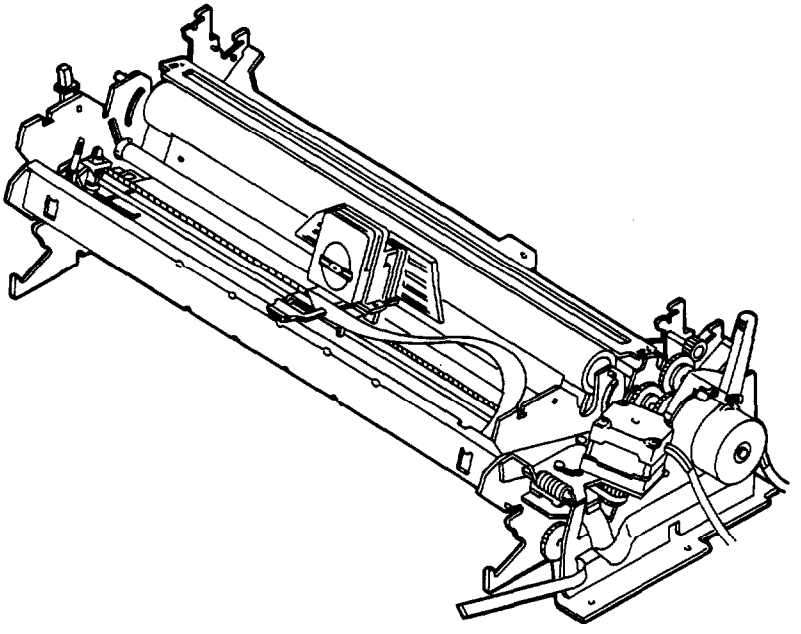


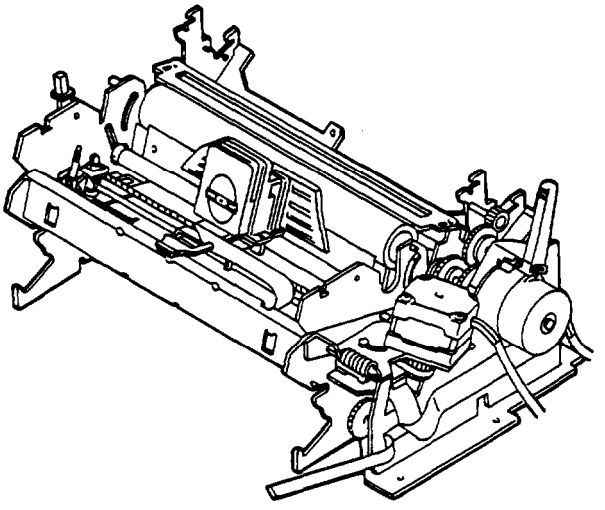
Figure 1-14. C076 PSB Board Assembly (Power Supply Circuit Board)

Printer Mechanism

The printer mechanism consists of a 9-pin impact dot head, a carriage mechanism, a carriage motor, a paper feed mechanism, a paper feed motor, a ribbon feed mechanism, and various sensors.



136-column model



80-column model

Figure 1-15. Printer Mechanism

Housing Assembly

The printer mechanism and all the boards are contained in a housing assembly that consists of the upper case and the lower case.

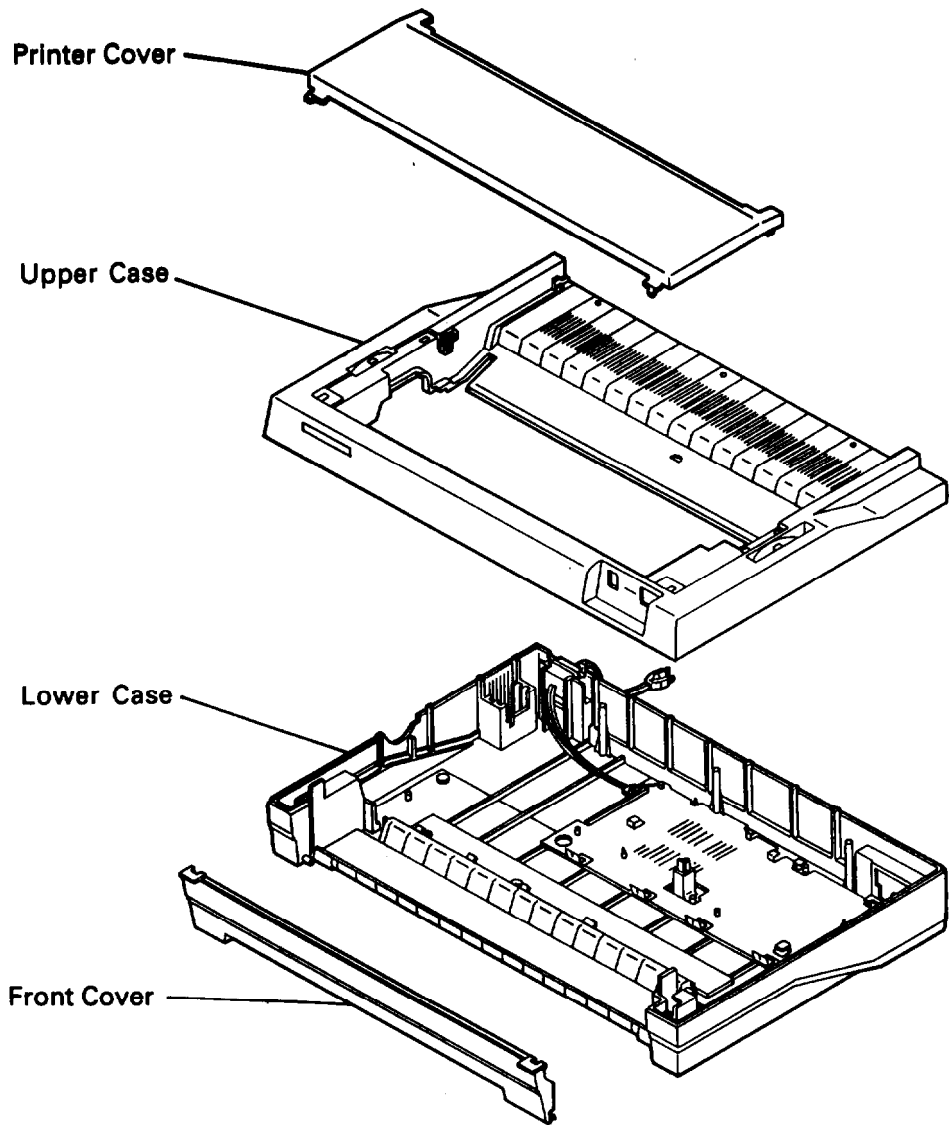


Figure 1-16. Housing Assembly

Commonly Asked Questions and Answers

This section contains facts that customers often want to know about this printer. The question-and-answer format is to make it easier for you to scan through the information.

1. Q. What are the FX-870 and FX-1170 printers?

   A. The FX-870 and FX-1170 printers are the direct **replacements for the FX-850 and FX-1050 printers.**

2. Q. What is the rated **print** speed for the FX-870 and the FX 1170?

   A. 380 cps in high-speed draft
   285 cps in draft pica
   342 cps in draft elite

3. Q. What printer **operating modes** are built into the **FX-870/1170?**

   A. • Epson **ESC/P**
   • IBM Proprinter (X or XL, for narrow or wide carriage)

4. Q. What are the **resident fonts are** in these printers, and are they scalable?

   A. Draft, Roman, and Sans Serif. The FX-870 and FX-1170 do not support Epson ESC/P2 scalable fonts.

5. Q. If the program I am running does not **list** the FX-870 or FX-1170 as a printer selection, what other printer can I select in my software?

   A. Acceptable **driver selections** for Epson mode are listed below in order of preference:

• FX-850	FX- 1050
. EX-800	EX-1000
• FX-86e	FX-286e
• **FX-80+**	FX-**100+**
• Epson Printer	
• **9-pin** Printer	

   Acceptable driver selections for IBM mode are listed below:

   • IBM Proprinter (**X** for narrow carriage or XL for wide carriage)

6. Q. What is the rated **life of the ribbon and printhead?**

   A. Ribbon 3 million characters at 14 dots per character
   Printhead 100 million characters at 14 dots per character

7. **Q.** Do the FX-870 and FX-1170 use the same **ribbons as** the FX-850 and FX-**1050?**

   A. **Yes.** 8750 (fabric) for the FX-870
   8755 (fabric) for the FX-1170
   8758 ribbon only replacement pack

   (Never use ribbons for 24-pin printers. To extend printhead life, use only the Epson ribbons listed above.)

8. Q. What is the **part number for the printhead?**

   A. F031000

   If any of the pins in the printhead are shorted, be sure to replace the main board at the same time as the printhead.

9. Q. What type of **interface** is built into the **FX-870/1170?**

   A. The FX-870 and FX-1170 have the most commonly used interface port:
   • Centronics parallel
   The printer also has an additional slot for an Epson Type B interface.

10. Q. What is the size of the **input buffer** for the built-in parallel interface?

    A. 24K (can be enabled or disabled in the default setting mode)

11. Q. What **accessories** are available for the FX-870 and **FX-1170?**

    A.

FX-870 Part No.	**FX-1170 Part No.**	**Description**
C806371	C806391	Single bin cut sheet feeder
C803681	C806401	High-capacity cut sheet feeder
C800201	C800211	Additional tractor unit
C814001	C814011	Front sheet guide
C823051	C823051	Serial interface
C823071	C823071	32KB serial interface
C823101	C823101	32KB parallel interface
C823141	C823141	Coax interface
C823151	C823151	**Twinax** interface
CI **-9E-A**	CI **-9E-A**	Parallel printer cable
8310		Roll paper holder (FX-870 only)

12. **Q.** What is the **capacity of the optional cut-sheet feeders?**

    A.

CSF	**Capacity**
Single-bin	50 sheets (no envelopes, multi-part forms, or labels)
High-capacity	150 **sheets/25** envelopes (no multi-part forms or labels)

13. Q. How many **paper paths** are there for the FX-870 and **FX-1170?**

A. The printers have 4 paper paths:

Top feed
Bottom feed
Rear feed
Front feed

14. Q. How is the **tractor** used for feeding with the **FX-870/1170?**

A. The FX-870 and FX-1170 come with one tractor, which can be positioned for three different types of feeding:

Front feed push tractor
Rear feed push tractor
Top-mounted pull tractor

15. **Q. How** many sheets of **multi-part paper** can the **FX-870/1170** handle?

A. **4,** including the original (carbonless only). The printer can handle **cut-**sheet multi-part forms using friction feed **from** the front sheet guide.

16. Q. Can the FX-870 and FX-1170 print on **labels?**

A. Yes, at normal temperature and humidity levels. Use continuous type labels only. Never back feed labels.

17. Q. Can the FX-870 and FX-1170 print on **envelopes?**

A. Yes, at normal temperature and humidity levels. You can use No. 6 and No. 10 envelopes (up to **.0197** inches thick).

18. Q. What is the printer's **duty cycle?**

A. 25%. This means that out of every hour, the **FX-870/1170** can print continuously for **only** 15 minutes.

19. Q. How do I get a printout of the current **printer** settings?

A. Hold down the PAPER FEED button while you turn on the printer.

20. Q. Are there DIP **switch** settings for these printers?

A. No. **All** default settings are made from the control panel and stored to the **E²PROM.** (For more information on setting the defaults, see page l-20.)

21. **Q.** What is the **decibel level** for the **FX-870/1170?**

A. 55 **dB(A).**

Chapter 2

Installation and Setup Procedures

List of Figures

Installation and Setup Procedures 2

This chapter provides tips to help you select a site, set up, and test the printer. There is information on the using the parallel and serial interfaces, along with cabling configurations for serial transmission. The last portion of the chapter provides information customers need to know about this printer to ensure maximum problem-free operation.

Site Requirements

Selection of a suitable location is essential to proper operation of the FX-870/1170. The printer must be placed on a level, stable surface in a clean environment, which is not subject to rapid fluctuations in temperature, vibration, or direct sunlight.

Use this list in placement of the printer:

- Place the printer on a stable, flat surface capable of supporting at least twice the weight of the printer (30 lb. for the narrow carriage printer or 40 lb. for the wide carriage).
- If you are using the built-in parallel interface, place the printer close enough to the computer that you need a cable no longer than 10 feet, maximum. If the printer must be farther than 10 feet from the computer, install an optional Type B serial interface.
- Leave adequate space around the printer for proper ventilation.
- Avoid electrical outlets controlled by wall switches or automatic timers. Accidental disruption of power can erase information stored in printer memory.
- Keep the entire computer system away from potential causes of electromagnetic interference, such as loudspeakers or the base unit of cordless telephones.
- Avoid dusty environments.

Removing the Packing Materials

Be sure to remove all the protective tape and packing material for the printer before attempting to put the printer together. Refer to the Notice Sheet inserted in the printer for directions. Save the packing materials in case the printer needs to be shipped later.

The Correct Power On Sequence

While the printer is plugged in, power is always applied to the secondary circuit. When you press the OPERATE button, the printer performs the following power on sequence:

- Checks RAM and E^2PROM
- Moves the carriage back and forth until it finds the home position.
- Lights control panel LEDs.

If the printer cannot complete this sequence successfully, refer to Chapter 3, ***Troubleshooting. Otherwise,*** turn the printer off, and perform the self-test.

Running the Self-Test

The self-test checks the printer mechanically and electronically to make sure it works properly. If the printer runs the self-test successfully, it means that everything is operational in the printer (with the possible exception of the interface circuit).

To run the self-test, hold down the PAPER PEED button while turning on the printer. You can use any paper path and any acceptable paper type to run the self-test. To stop the self-test, simply turn off the printer.

Connecting Printer Cables

Parallel Cables

The cable you connect to the built-in parallel Centronics interface should be a shielded, twisted-pair cable no longer than 10 feet (3 meters), maximum. If the cable has a frame ground connector, attach it to the frame ground terminal beside the parallel connector in the back of the printer. (See Table 1-13 for pin assignments and signal functions for the parallel interface.)

Serial Cables

If you install an optional Type B interface in the printer slot, you must use an RS-232C null modem cable.

The cable configuration for connecting the printer serially to a 9-pin (AT-type) computer connector is shown in the figure below.

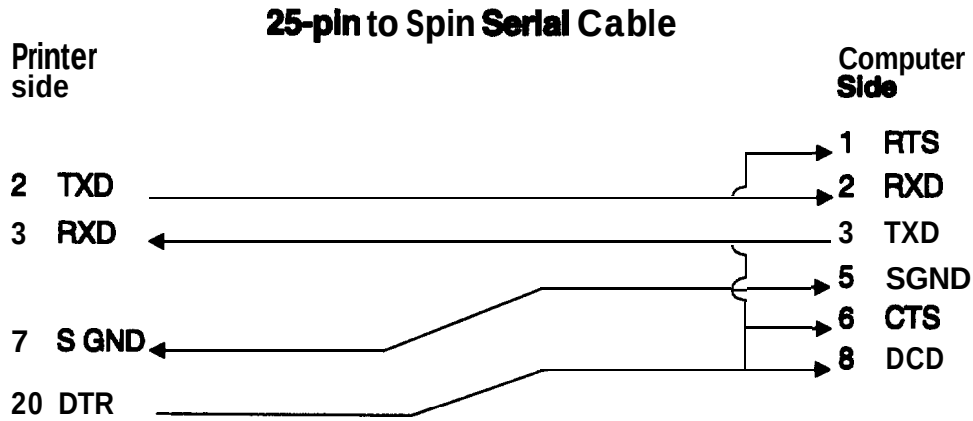


Figure 2-1. Serial Cable Configuration to a O-Pin Computer Connector

The cable configuration for connecting the printer serially to a **25-pin** (XT-type) computer connector is shown in the figure below.

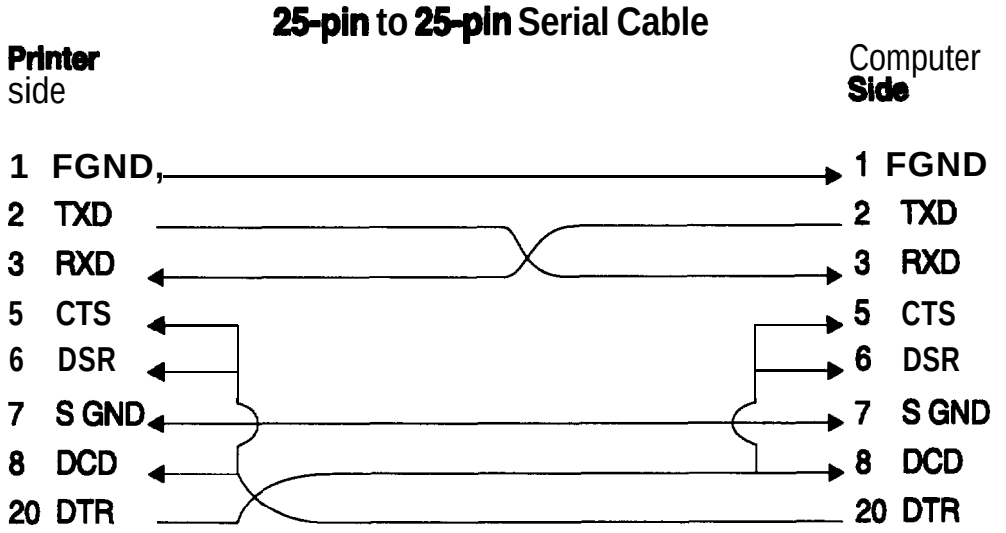


Figure 2-2. Serial Cable Configuration to a 25-Pin Computer Connector

Checking the Printer with the Computer

The paragraphs below describe ways to check the computer's connection to the printer. If you have problems after performing these checks, see Chapter 3, ***Troubleshooting.***

Parallel Connection to an MS-DOS Computer

Once you have connected the printer to the computer, you can test the connection by sending a print screen to the printer. (At the MS-DOS prompt, type DIR and press Enter. Then press Print Screen or Shift+Print Screen.)

If the printer does not respond, try modifying the MS-DOS MODE command. From the MS-DOS directory, type the following command and press Enter:

```
MODE LPTn,,P
```

In this command, ***n*** represents the port you are sending data through (typically **LPT1** or **LPT2)** and P specifies unlimited retries for time-out errors. The computer will respond with the message:

```
Resident portion of MODE loaded

Infinite retry on parallel printer time-out
```

Then try sending a print screen again or type: DIR > PRN and press Enter at the MS-DOS prompt to print a listing of the current directory.

(If you needed to change the MS-DOS MODE command to reroute the computer's output to the correct port, edit the system's AUTOEXEC.BAT file to include this MODE command automatically.)

Serial Connection to an MS-DOS Computer

Assuming you installed a 0KB or 32KB serial interface and did not change the DIP switches on the interface card, the interface is set for the following:

9600 baud, 8 data bits, no parity.

To match this setting in the host computer, change the interface configuration. From the MS-DOS directory, type the following MS-DOS command and press Enter:

```
MODE COMn:N,8,1,P
```

In this command, *n* represents the port you are sending data through (typically COM1 or COM2), N means no parity, 1 is one stop bit, and P specifies unlimited retries for time-out errors. The computer will respond with the message:

```
Resident portion of MODE loaded

Infinite retry on serial printer time-out
```

To verify the connection, send a print screen to the printer. (At the MS-DOS prompt, type DIR Enter. Then press Print Screen or Shift+Print Screen.) Or, type: DIR > PRN and press Enter at the MS-DOS prompt to print a listing of the current directory.

(If you needed to change the MS-DOS MODE command to reroute the computer's output to the correct port, edit the system's AUTOEXEC.BAT file to include this MODE command automatically.)

Tips to Increase Printer Life

Although the FX-870/1170 does not require any routine maintenance, there are a few things Epson owners can do to prolong the life of their printer:

- Do not print continuously for long periods of time.

  The FX-870/1170 has a 26% duty cycle. This means that it is built to run continuously for 15 minutes out of every hour. Exceeding the duty cycle can cause the printhead to overheat. Although the printhead has a built-in thermistor to protect it, if the printer overheats repeatedly, it can result in printer failure.

- Use only ribbons recommended by Epson for this printer, and do not re-ink ribbons.

  The ink in the Epson-recommended ribbons for this product is especially formulated with a lubricant that makes the printhead last longer. The ink in cheap ribbons can gum up the printhead. Be-inking a used ribbon can cause the printhead pins to catch on the worn ribbon fabric.

Chapter 3

Troubleshooting

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Troubleshooting 3

The information in this section can help you identify causes of printer problems and test the printer to isolate the part that needs to be replaced. The chapter also contains illustrations showing connector locations and sensor locations. Once you have read this chapter to determine what tests you need to run on the printer, see Chapter 4 for instructions on how to disassemble the printer.

WARNING

Before disassembling the printer to perform any troubleshooting tests, disconnect the power supply cable from the AC power outlet. Failure to do so may cause physical injury. The power switch is wired in the secondary circuitry. Therefore, the printer's primary circuitry remains live even after the power switch is turned off.

When performing the testing described in this chapter, do not connect the printer to the power source unless instructed to do so in the test. When the power supply must be connected, use extreme caution, because the voltage may cause physical injury and may , damage the components of the printer.

Test Points

The test point tables and diagrams have been placed at the front of this chapter to provide you with a quick reference for checking motors, the printhead, printhead drivers, sensors, and the power supply, if you suspect a problem.

Table 3-1. Power Supply Test Points

Power Supply Connector Pin Numbers	Test Method (Set Meter to Continuity. Check with Printer Power Off.)	Meter Reading
11 and3 (CN2)	Place one lead on pin 11 and the other on pin 3 (ground).	Continuity/open means OPERATE is activated and you can check the power supply voltages.
Power Supply Connector Pin Numbers	**Test Method (Set Meter to Volts. Check with Printer Power On.)**	**Meter Reading**
1 and3 (CN2)	Place the + lead on pin 1 (5 V) and the – lead on pin 3 (ground).	+5 v
9 and 3 CN2	Place the + lead on pin 9 (35 V) and the – lead on pin 3 (ground).	+35 v

Table 3-2. Sensor Test Points

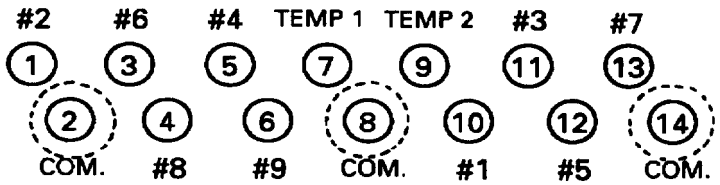
Sensor Connector Number	Test Method (Set Meter to Ohms. Check with Printer Power Off.)	Meter Reading
Release Lever (CN4)	Place one lead on each pin. Change the release lever position.	Meter should toggle between open and short.
Platen Gap **(CN5)**	Place one lead on each pin. Change the adjust lever position.	Meter should toggle between open and short.
CR Home (CN7)	Place one lead on each pin. Move carriage to and away from home position.	Meter should toggle between open and short. (Closed = active.)
Front PE (CN3)	Place one lead on each pin. Toggle sensor by inserting and removing paper.	Meter should toggle between open and short. (Open = active.)
Sensor Connector Number	**Test Method (Set Meter to Volts. Check with Printer Power On.)**	**Meter Reading**
Rear PE **(CN9)**	Place one lead on pin 3 (GND) and one on pin 2 (PER). Toggle by inserting and removing paper.	Meter should toggle between 0 V and HIGH.

Note: Illustrations later in this chapter show sensor locations.

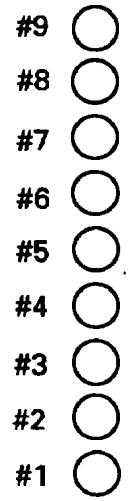
Table 3-3. Motor Test Points and Coil Resistance

Motor Connector Number	Common Pin Numbers	Test Pin Numbers	Test Method (Set Meter to Ohms. Disconnect Motor from Main Board and Check it with Printer Power Off.)	Meter Reading
Carriage Motor (CN13)	5	**1, 2, 3, 4**	Place one lead on pin 5 and the other lead on each of the four test pins to check the four motor phases.	**5 Ω ± 7%** (at **77°** F, 25" C)
Paper Feed Motor **(CN6)**	6 5	1 and2 **3 and 4**	Put one lead on pin 6 and the other lead on pin 1 and then on pin 2. Put one lead on pin 5 and the other lead on pin 3 and then on pin 4.	**63 Ω ± 3 Ω** (at **77°** F, 25" C)

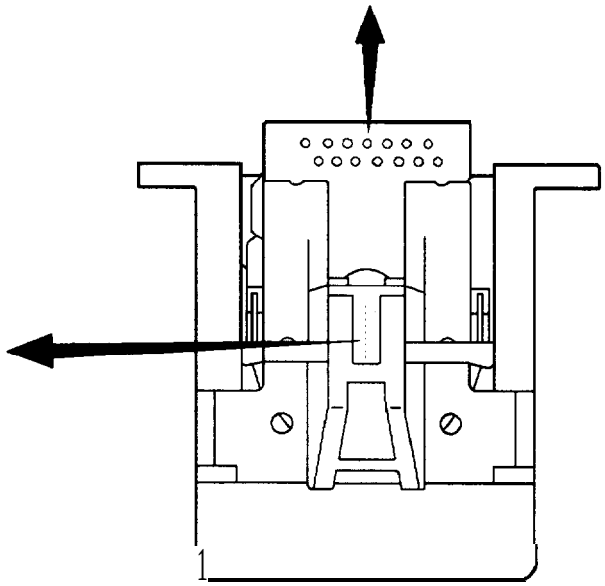
Notes:
- Common pins may be reversed. If you do not obtain the proper reading with one common, try the other common for that motor. If you still do not obtain proper readings, the motor is bad.
- If any phase of the motor is shorted, see Table 3-6 to check the main board. (If the drivers on the main board are also shorted, and the board is not replaced at the same time as the motor, the short in the main board drivers may burn out the new motor.)



[TERMINAL ASSIGNMENT]



[WIRE ASSIGNMENT]



Note:
The printhead is upside down in this illustration.

Note: The commons correspond to the following printhead dot wires:

COM. 2 = **#2, #4, #6**
COM. 8 = **#7, #8, #9**
COM. **14 = #1, #3, #5**

Figure 3-1. Printhead Resistance

Table 3-4. Printhead Test Points and Coil Resistance

Connector Number	Common Pin Numbers	Connector Test Pin Numbers	Test Method (Set Meter to Ohms. Disconnect Printhead and Check it with Printer Power Off.)	Meter Reading
Printhead	2	**1, 3, and 5**	Place one lead on pin 2 and the other on test pins **1, 3,** and 5 to check the resistance of printhead dots **#2, #4,** and **#6.**	**16.5 Ω ± 1.6 Ω** (at **77°** F, 25" C)
	8	**4, 6,** and 13	Place one lead on pin 8 and the other on test pins 4, 6, and 13 to check the resistance of printhead dots **#7, #8,** and **#9.**	
	14	**10, 11,** and 12	Place one lead on pin 14 and the other lead on each of the test pins 10, 11, and 12 to check the resistance of printhead dots **#1, #3,** and **#5.**	
Thermistor	—	**7 and 9**	Place one lead on each pin.	Approx. 9.3 K **Ω**

Table 3-5. Printhead Driver Test Points

Transistor Numbers	Test Method (Set Meter to Diodes. Check with Printer Power Off.)	Meter Reading
Q2, Q4, Q5 Q6, Q8, Q9 Q10, Q11, Q12	Emitter and base are marked on the CO94 MAIN board. Check from base to collector, from base to emitter, and from emitter to collector. Reverse leads and test again.	Consistent readings for all transistors, within ± 20%. Not open and not shorted between base and collector and base and emitter.
Q3, Q7, Q13		

Table 3-6. Carriage and Paper Feed Motor Driver Test Points

CR Motor Driver (IC6) Pin Numbers	Test Method (Set Meter to Diodes. Check with Printer Power Off.)	Meter Reading
1, 8, 11, and 18 on chip SLA7024M	Pins 1 and 18 are marked on board. All odd pins are on one side, and even are on the other. Place + lead on pin 4 (ground) and – lead on each of the four pins.	Consistent readings from all pins within ± 20%. Not open and not shorted. (The typical reading is 547, but the reading is not as important as consistency.)
PF Motor Driver (IC1) Pin Numbers	**Test Method (Set Meter to Diodes. Check with Printer Power Off.)**	**Meter Reading**
3, 5, 7, and 9 on chip UPA1476H	Pins 1 and 10 are marked on board. Place + lead on pin 1 (ground), and count over to find each of the four pins to be checked.	Consistent readings from all pins within ± 20% Not open and not shorted. (The typical reading is .672, but consistency is most important.)
PF Transistor	**Test Method (Set Meter to Diodes. Check with Printer Power Off.)**	**Meter Reading**
Q15	Emitter and base are marked on board. Check from base to collector, from base to emitter, and from emitter to collector. Reverse leads and test again.	Consistent readings for all transistors, within ± 20%. Not open and not shorted between base and collector and base and emitter.

Error Codes

Table 3-7. Error Codes

Error Warning	Error	Cause
3uzzer beeps: •• •••	Carriage error	Use flowchart 2 in this chapter to isolate the problem.
3uzzer beeps: • •• •• ••	Memory error	RAM abnormality.
3uzzer beeps: • •• •• •• ••	Memory error	E^2PROM abnormality.
3uzzer beeps: •••• •••• •••• •••• ••••	Paper out error	• Continuous paper has run out. • There is no cut sheet paper in the CSF. • No paper was present at the start of a self-test. • The CSF cannot eject a sheet.
Buzzer beeps: ••	Paper out error	• Single sheet feed is selected and no paper is present. • Continuous paper cannot be loaded. • Paper runs out after the PAPER FEED button has been pressed.
Buzzer beeps: ••••••••• (continuously).	Paper release error	The paper release lever is set to an inappropriate position.
All indicators blink simultaneously.	Fatal error	Voltage error, head thermistor error, bad RAM, CPU, or other fatal error.
All indicators blink simultaneously quickly.	Memory error	Incorrect RAM
All indicators blink sequentially in the clockwise direction.	High-voltage error	The power supply voltage is abnormal. Use flowchart 1 in this chapter to isolate the problem.
All indicators blink sequentially in counter-clockwise direction.	Thermistor error	The head thermistor has an open circuit error.
All indicators are on.	Low-voltage error	The power supply voltage is abnormal. Use flowchart 1 in this chapter to isolate the problem.

Note: In the table above, each • represents one beep. See Table 1-21 for information on non-error buzzer functions.

Problem Isolation

Most printer problems can be corrected by replacing the defective unit. First, identify the problem from the symptoms you observe using the table below. Then, follow the instructions in the corresponding flowchartto correct the problem.

Table 3-8. Symptoms and Flowchart References

Symptom	Possible Problems .	Flowchart or Solution
Printer dead, or abnormal operation at power on.	• Possible power supply voltage problem. • A motor or printhead may be shorted. . CO94 MAIN board may be bad.	See Chart 1.
Carriage does not move, or carriage operation abnormal.	• Something in the mechanism may be catching. • Sprocket or ribbon driie gears may be stuck or broken. • CR HOME sensor may be bad. • Carriage motor may be bad. • Driver for CR on CO94 MAIN board may be bad.	See chart 2.
Paper does not feed, or paper feeds abnormally.	• Something in the mechanism may be catching. • Paper feed motor may be bad. • Driver for PF on CO94 MAIN board may be bad.	See Chart 3.
Self-test printout has poor quality.	• Platen gap may be incorrect. • Printer may need bidirectional adjustment. • Head cable may be bad. • Printhead may be bad. • Printhead drivers on CO94 MAIN board may be bad.	See Chart 4.
Printing is darker on one side of the page than on the other side.	• Platen may not be parallel to carriage guide shaft.	Perform platen gap adjustment.
Printing is intermittently dark and light.	• Ribbon may be bad. • Ribbon mask may be damaged. • Sprocket or ribbon drive gears may be stuck or broken. • Platen gap may be incorrect.	See Chart 5.
Data from the host is printed incorrectly. (Host is assumed to have checked out OK with another printer.)	• Printer default settings may be wrong for application. • Interface cable may have a problem. • Software settings may be incorrect for printer. • Possible problem with ROM or CO94 MAIN board.	See Chart 6.

Table 3-8. Symptoms and Flowchart References (Continued)

Symptom	Possible Problems	Flowchart or Solution
When I try to load paper, the printer feeds it back out.	• There is a problem with one of the PE sensors. • The main board is not reading sensor output correctly.	Use Table 3-2 to test front and rear PE sensor.
The printer continues printing beyond the paper end onto the platen.	• There is a problem with one of the PE sensors. • The CO94 MAIN board is not-reading sensor output correctly.	
After I micro adjust top margin, the top margin of subsequent pages is wrong or drifts down the page.	• Page size may be set incorrectly in printer. • Application software may be set incorrectly. • CO94 MAIN board may have a problem.	See Chart 7.
The carriage slams into the right side of the printer, or the printer doesn't find home after power on.	• There is a problem with the HP sensor. • The CO94 MAIN board is not reading the sensor correctly. • (For narrow carriage printer) the main board E²PROM may have the wrong carriage width.	Use Table 3-2 to test sensor. If problem is with the E²PROM, call dealer BBS at (800) 234-i 445 for Version 4.0 of Confidence Test to reprogram.
The FX-1170 will print only BO columns.	• The E²PROM on the CO94 MAIN board contains the wrong carriage width.	Call dealer BBS at (800) 234-1445 for Version 4.0 of Confidence Test to reprogram.
The printer double-spaces lines of text.	• Auto LF is set to ON in default setting mode. • Software is set up incorrectly. • (If parallel) computer is constantly holding pin 14 LOW.	See Chart 8.

Serial Communications Errors

Some common serial data transmission problems can be identified by their symptoms. The table below lists these problems and their corresponding solutions.

Table 3-9. Identifying Serial Communications Errors

Problem	Possible Cause	Solution
Garbled print	• Baud rate mismatch • Parity mismatch	Verify DIP switch settings on the interface card. Type a MODE command at the MS-DOS prompt to match these settings. For instance, if the serial interface card's switches are in the factory setting, type: MODE=COMn:9600,N,8,1,P ("n" is the number of the COM port you are using.)

Table 3-9. Identifying Serial Communications Errors (Continued)

Problem	Possible Cause	Solution
Device timeout error	• The computer is not set for infinite retries to the printer.	Type a MODE command from the MS-DOS prompt that includes the infinite retry parameter. For instance, if the serial interface card's switches are in the factory setting, type: MODE=COMn:9600,N,8,1,P ("n" is the number of the COM port you are using.) The P parameter at the end of the command sets infinite retries to the printer.
Characters are printed as graphics or are printed in italics.	• Bit word length mismatch	Verify the word length set with DIP switch 1-2 on the interface card. To be sure that the computer is set to the same setting, type a MODE command from the MS-DOS prompt. For instance, if the serial interface card's switches are in the factory setting, type: MODE=COMn:9600,N,8,1,P ("n" is the number of the COM port you are using.) The 8 parameter in the command sets the word length to 8 bits.
The printer outputs a couple of pages and then stops.	• Handshaking problem • Cable problem	Verify that computer and printer are using the same type of handshaking. One cannot use BUSY/READY if the other is using XON/XOFF. Check the cable configuration. (See Figure 2-1 and Figure 2-2.)
Nothing is printed.	• Cable problem • Baud rate mismatch	Check the cable configuration. (See Figure 2-1 and Figure 2-2.) Verify the baud rate set with the DIP switches on the interface card. To be sure that the computer is set to the same setting, type a MODE command from the MS-DOS prompt. For instance, if the serial interface card's switches are in the factory setting, type: MODE=COMn:9600,N,8,1,P ("n" is the number of the COM port you are using.)

Chart 1. Printer Dead at Power On

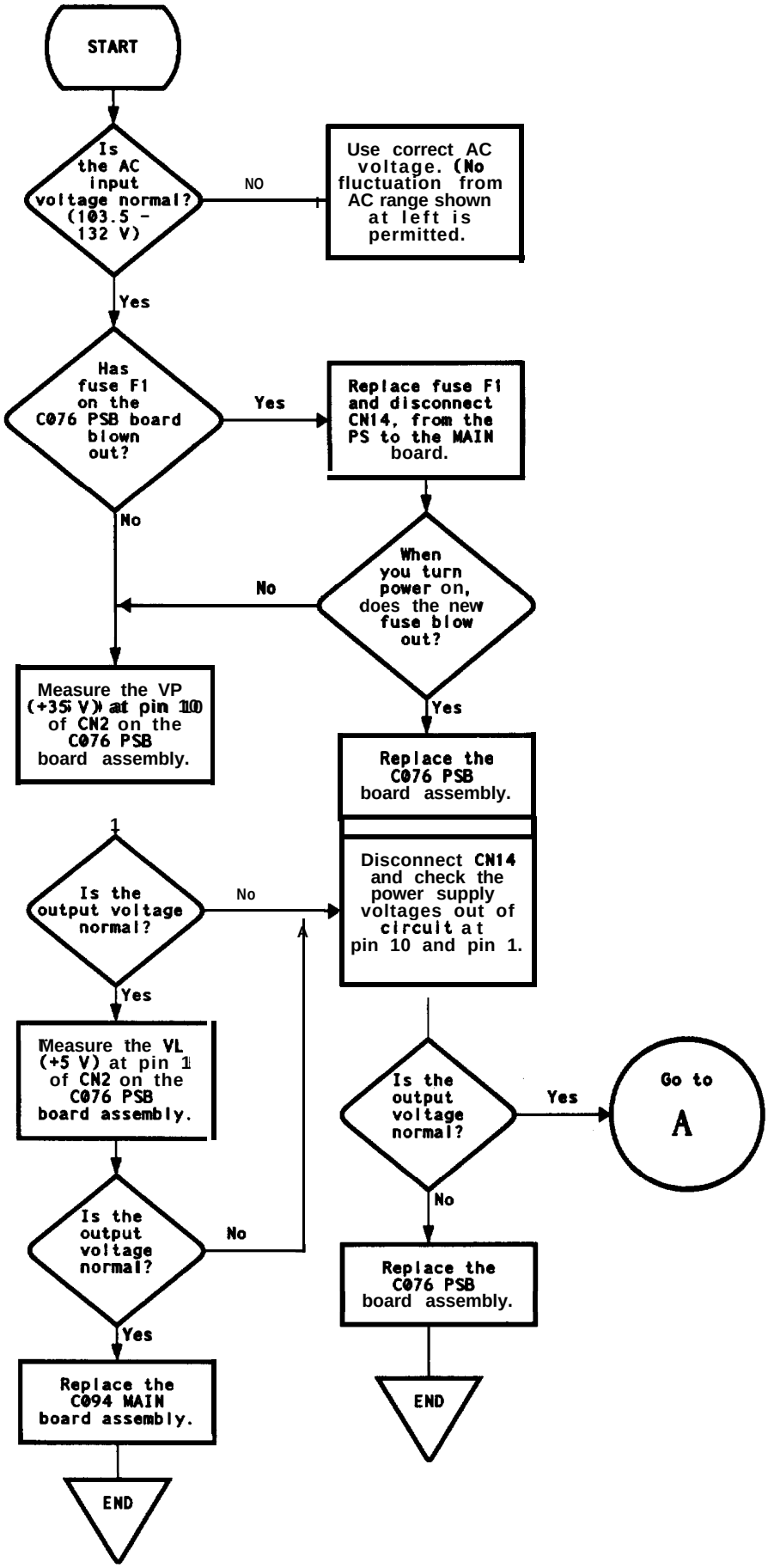


Chart 1. Printer Dead at Power On (Continued)

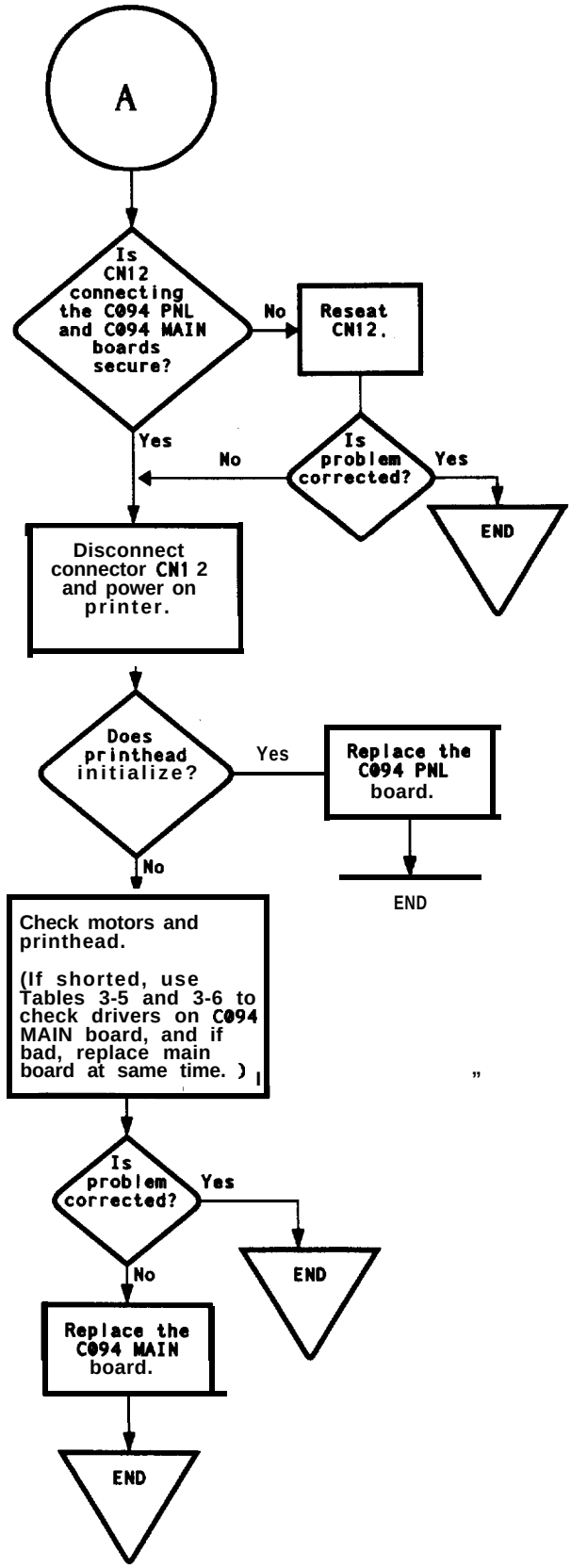


Chart 2. Carriage Does Not Move or Moves Abnormally

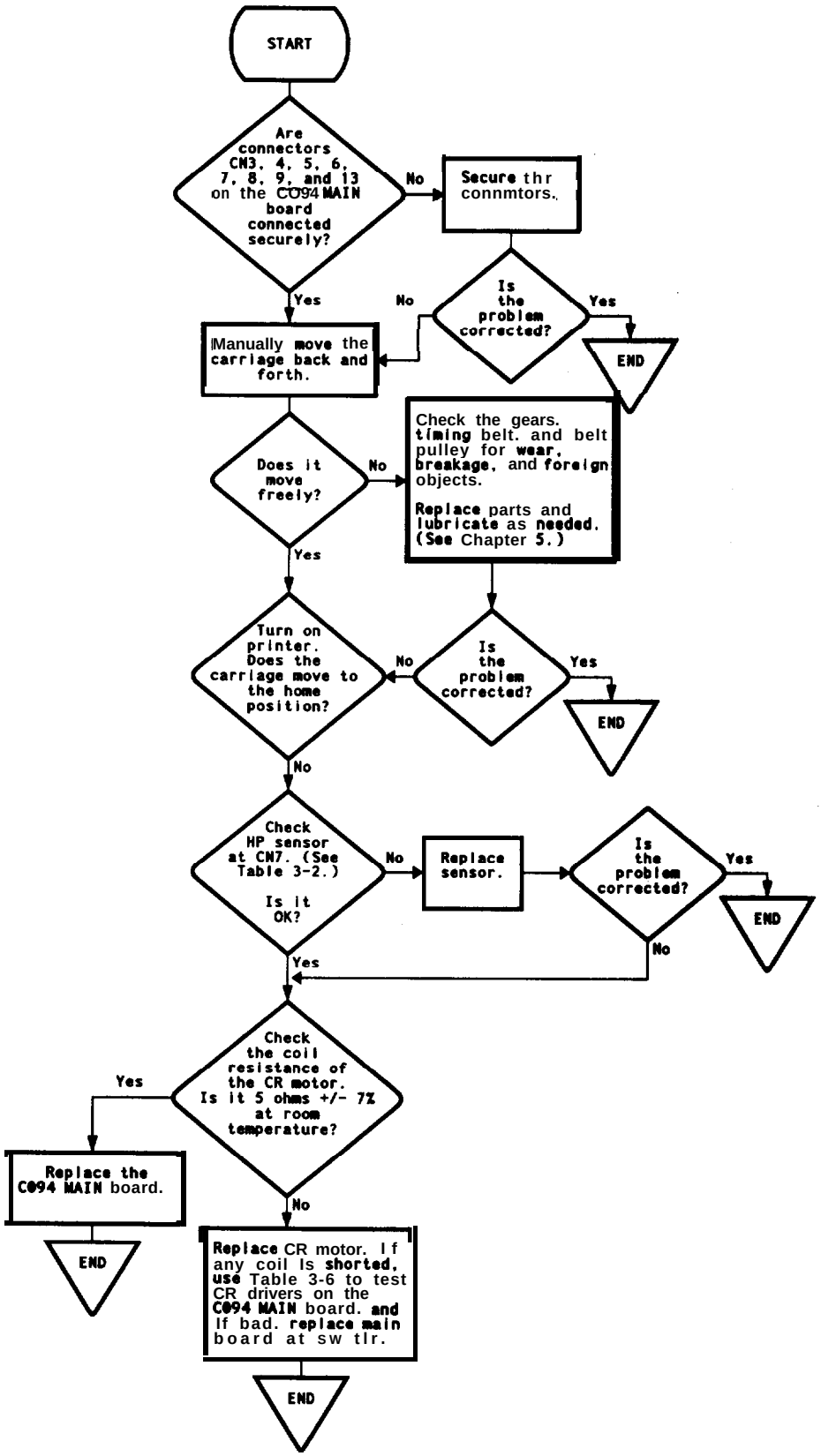


Chart 3. Paper Does Not Feed or Feeds Abnormally

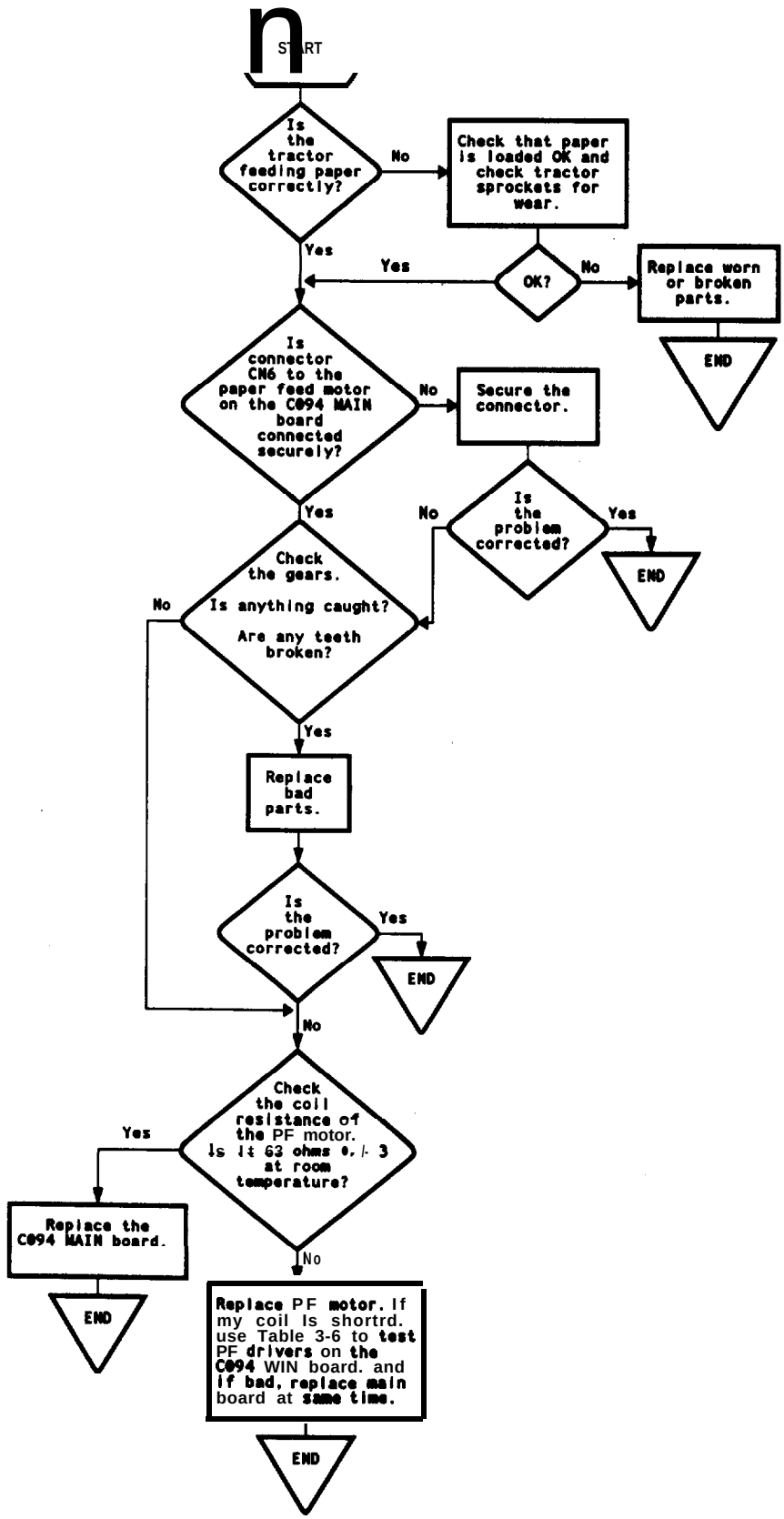


Chart 4. Poor Print Quality in Self-Test

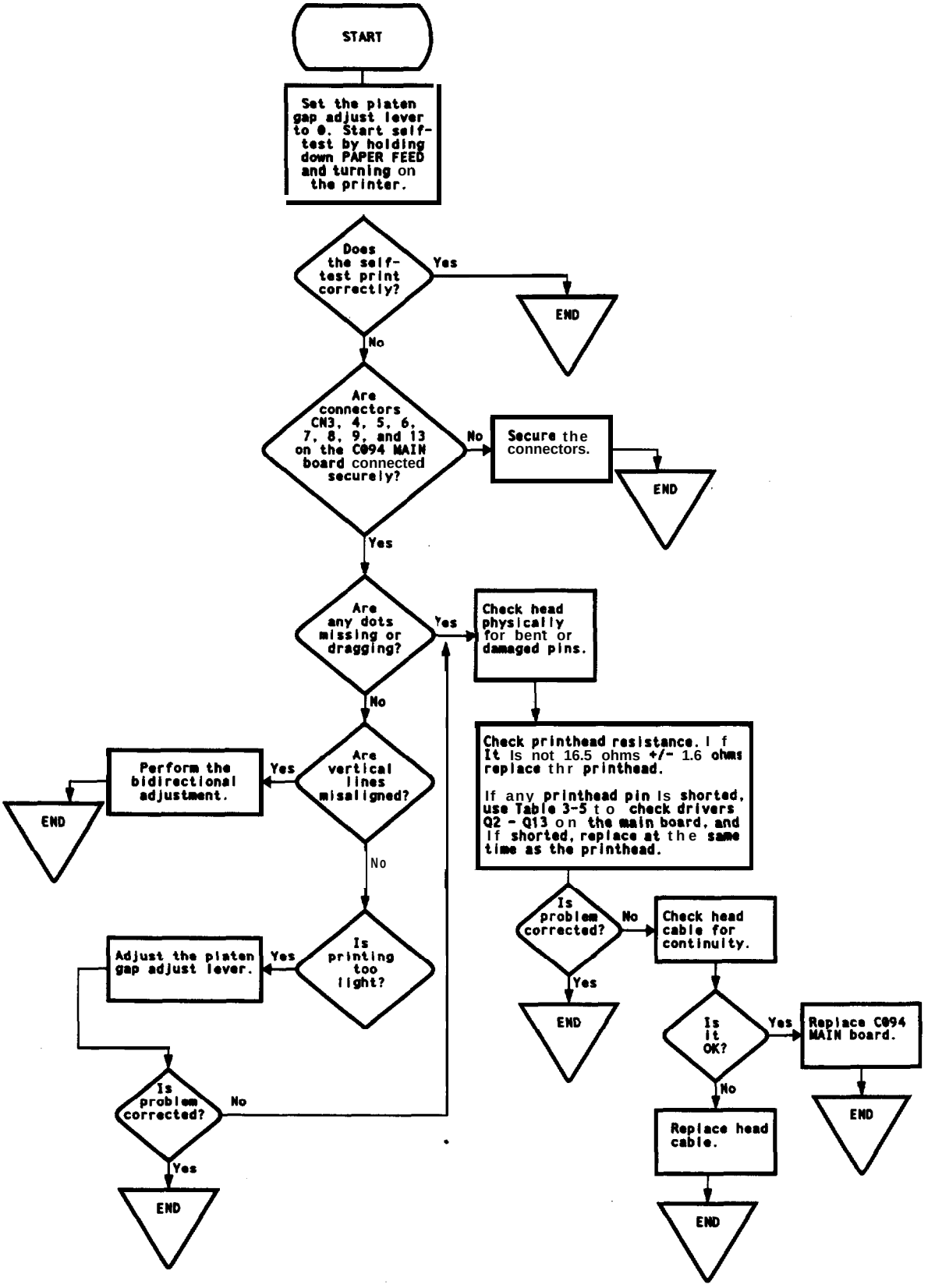


Chart 5. Ribbon Not Feeding Properly

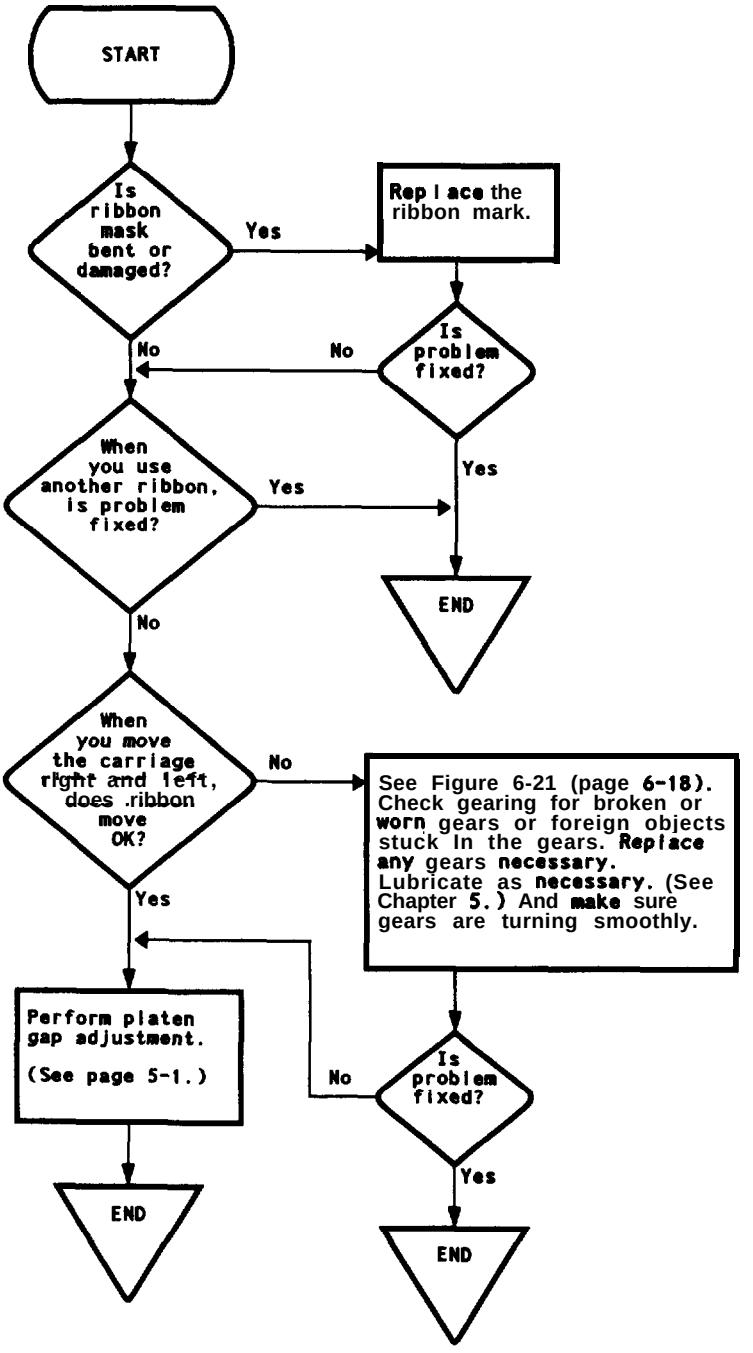
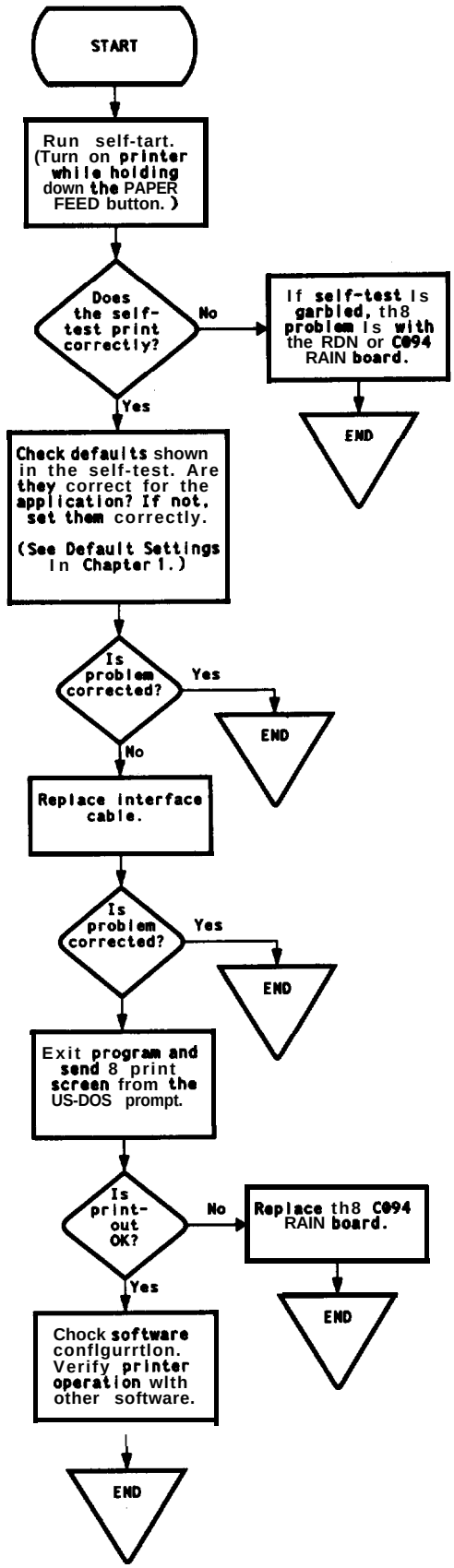


Chart 6. Data from Host is Printed Incorrectly



Note: The host computer is assumed to be operating normally.

Chart 7. Page Length/Margins Incorrect

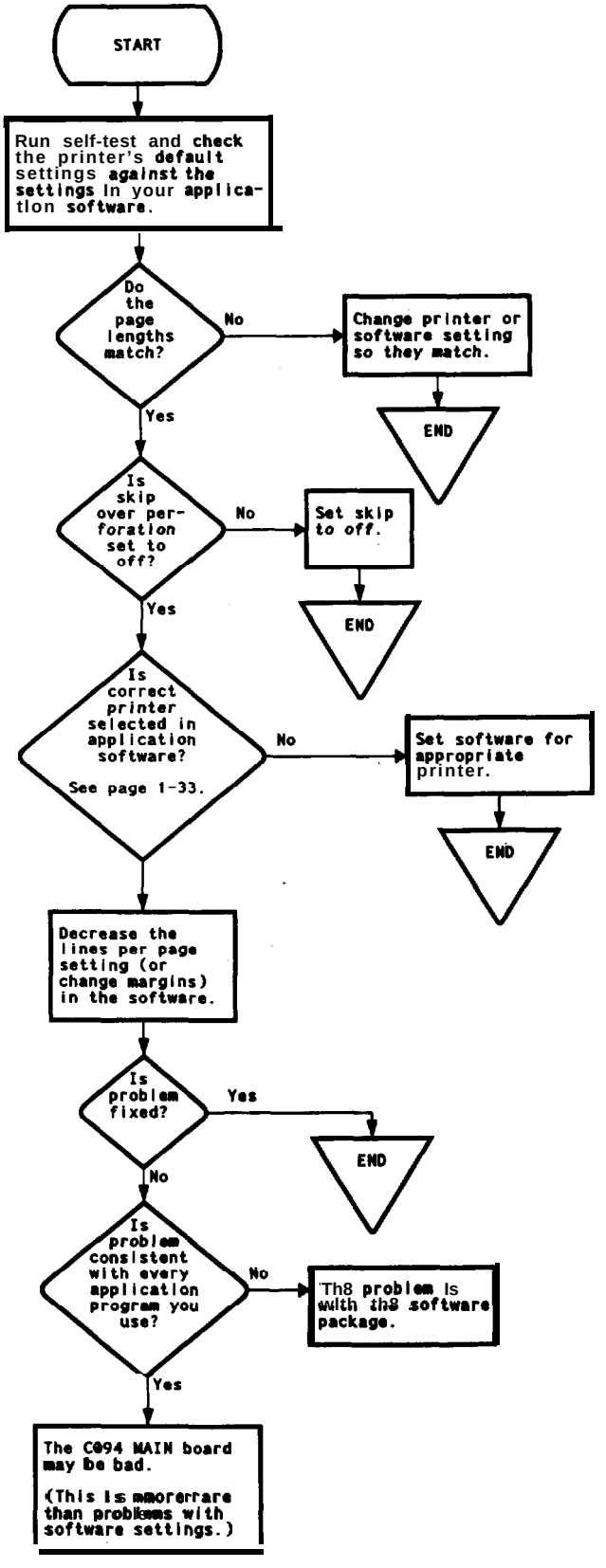
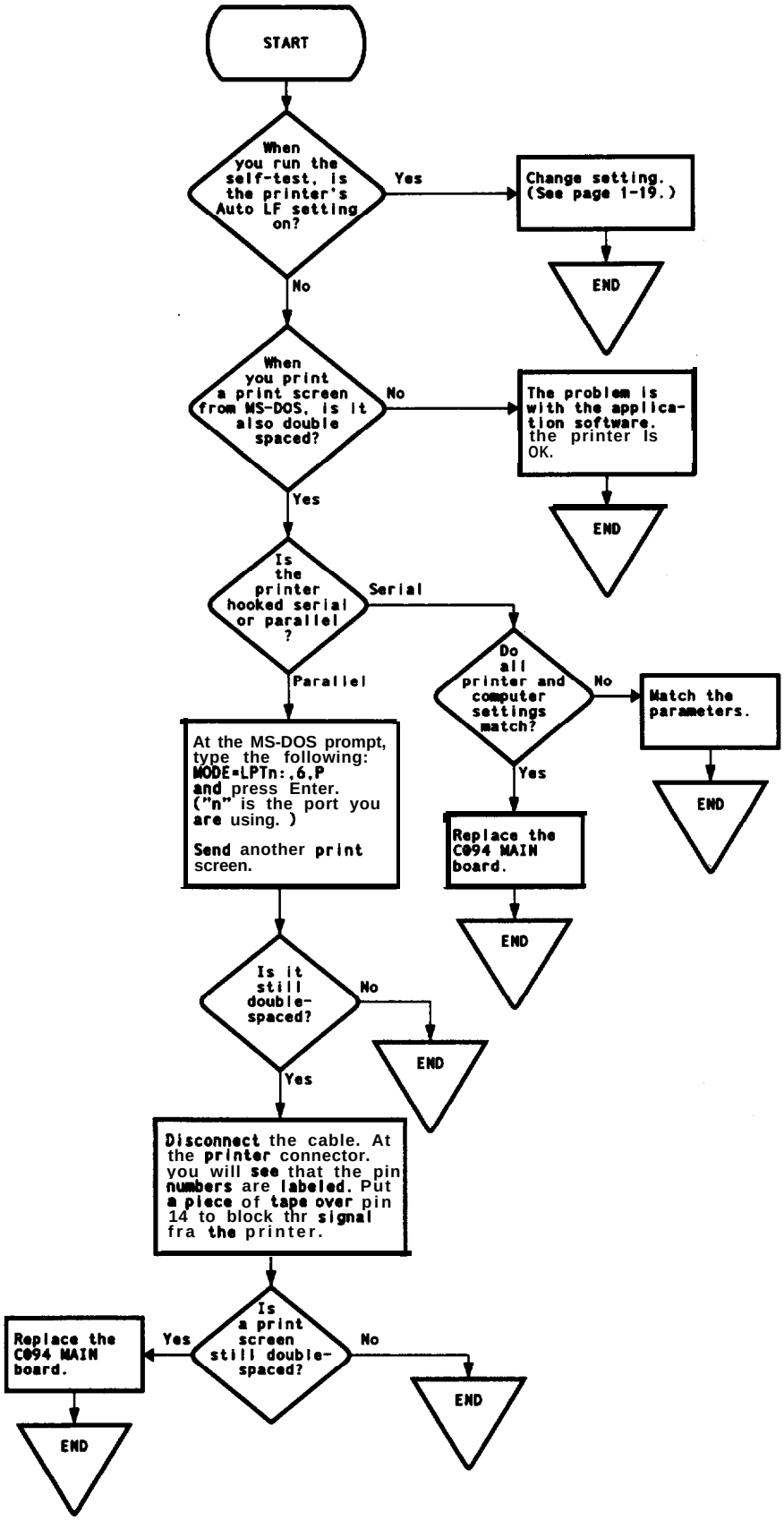


Chart 8. Printout Double-Spaced



Connector Locations

The layout diagram below shows the positions of connectors on the C094 MAIN board.

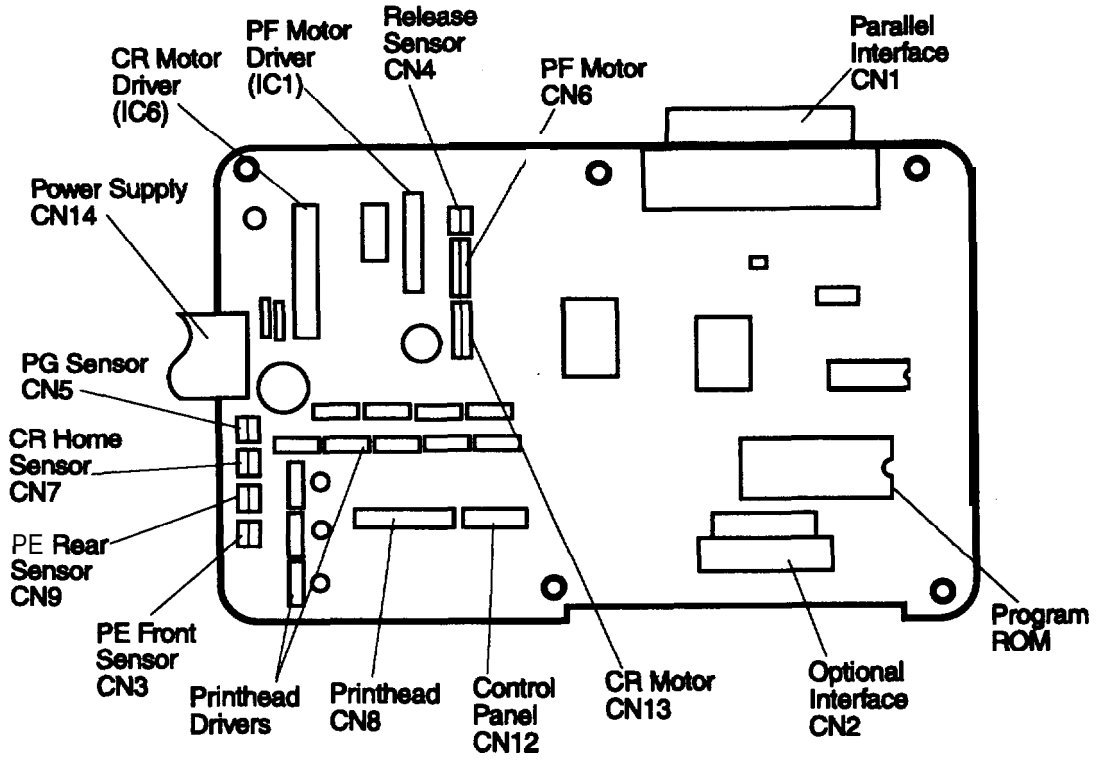


Figure 3-2. Connector Locations

Sensor Locations

The illustrations below show the locations of sensors in the printer mechanism.

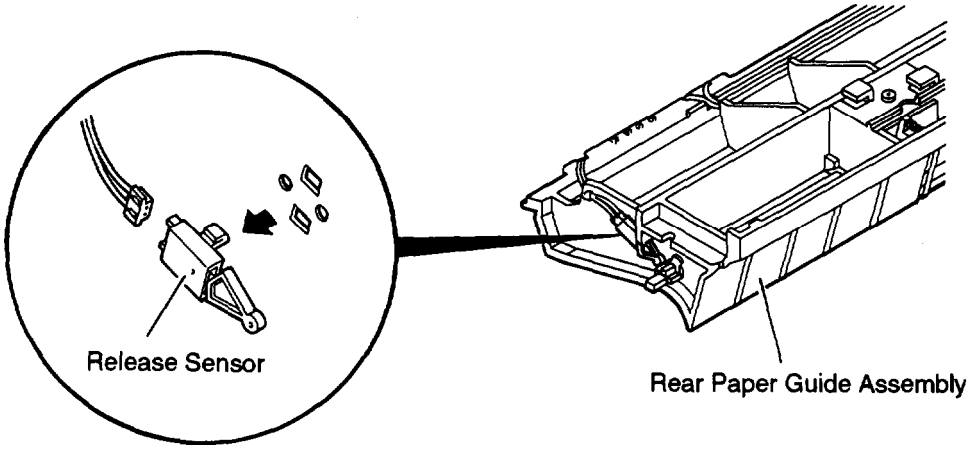


Figure 3-3. Release Sensor

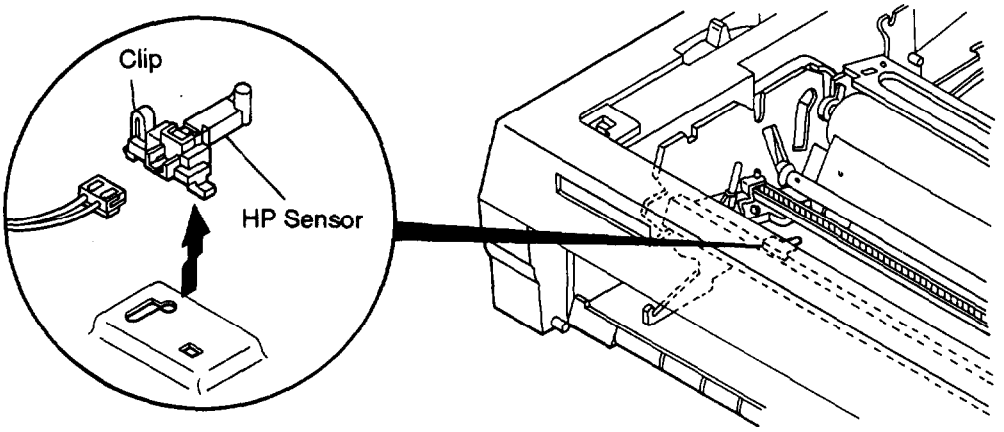


Figure 3-4. Home Position Sensor

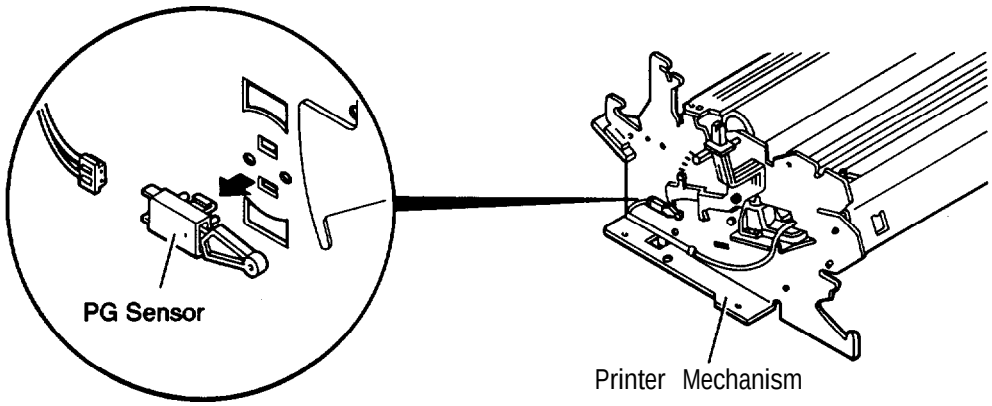


Figure 3-5. Platen Gap Sensor

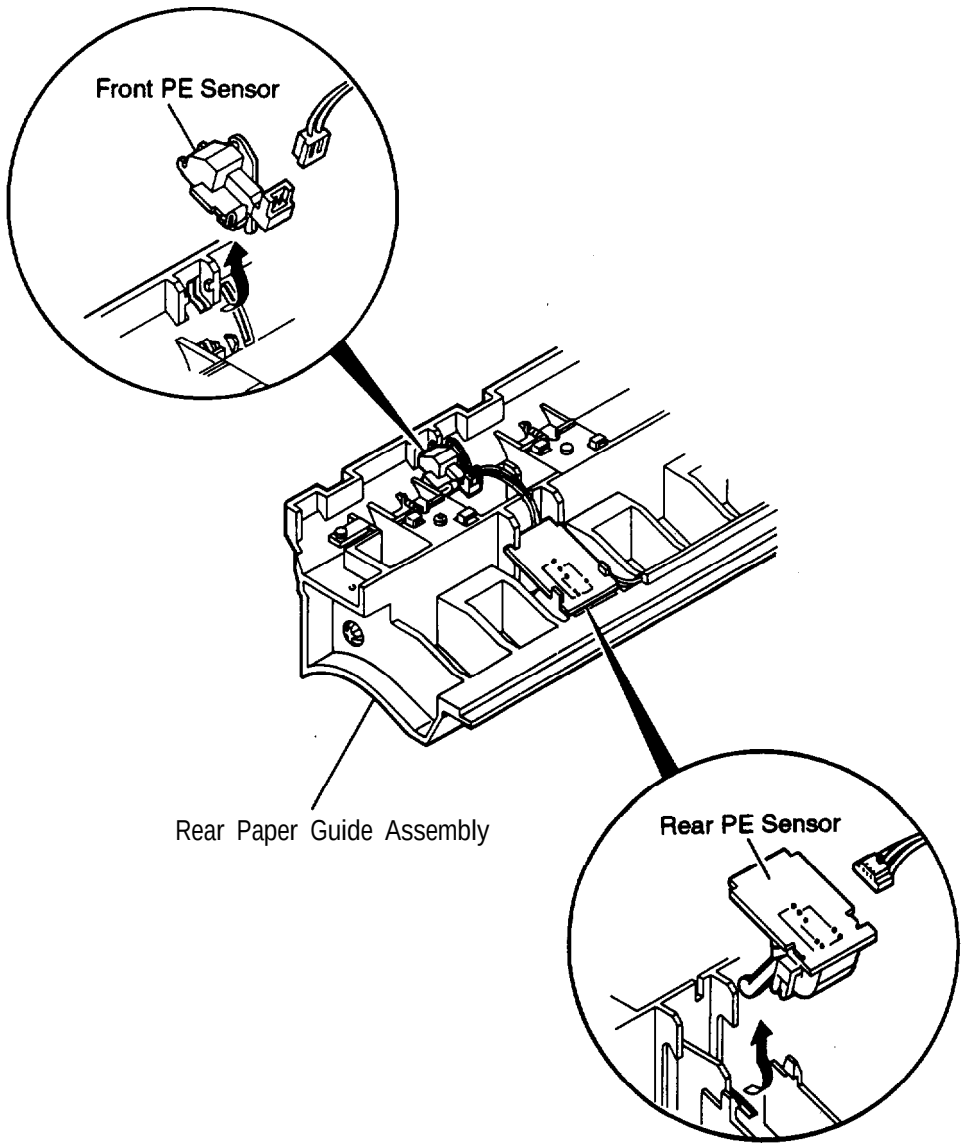


Figure 3-6. Front and Rear PE Sensors

Hex Quick Reference Table for ESC/P Commands

Use the table below as an aid to read printer hex dumps. This table is for quick reference only. The user's guide contains a detailed description of the control codes.

Table 3-10. Hex. Codes for ESC/P Commands

Hex.	Dec.	ASCII	Command
07	07	BEL	Beeper
08	08	BS	Backspace
09	09	HT	Horizontal tab
OA	10	LF	Line feed
OB	11	VT	Vertical tab
oc	12	FF	Form feed
OD	13	CR	Carriage return
OE	14	s o	Select double-width mode (one line)
OF	15	SI	Select condensed mode
11	17	DC1	Select printer
12	18	DC2	Cancel condensed mode
13	19	DC3	Deselect printer
14	20	DC4	Cancel double-width mode
18	24	CAN	Cancel line
19	25	ESC EM n	Turn cut-sheet feeder on/off, select bin, eject sheet
20	32	ESC SP n	Set intercharacter space
21	33	ESC!n	Master select
23	35	ESC #	Cancel MSB control
24	36	ESC $ nl n2	Set absolute horizontal print position (n = (nl + n2 x 256)/60")
25	37	ESC %n	Select user-defined set
26	38	ESC & nn	Define user-defined characters
28 74	40 116	ESC(tnn	Assign character table
2A	42	ESC * mn	Select graphics mode
2D	45	ESC - l/O	Turn underlining on/off
2F	47	ESC / c	Select vertical tab channel (c = channel 0 - 7)
30	48	ESC 0	Select 1/8-inch line spacing
31	49	ESC 1	Select 7/72-inch line spacing
32	50	ESC 2	Select 1/6-inch line spacing
33	51	ESC 3 n	Set n/216-inch line spacing
34	52	ESC 4	Select italic mode
35	53	ESC 5	Cancel italic mode
36	54	ESC 6	Enable printable characters
37	55	ESC 7	Enable upper control codes
38	56	ESC 8	Disable paper-out detection
39	57	ESC 9	Enable paper-out detection
3A	58	ESC:OnO	Copy ROM to RAM (n = 0 copies Roman; n = 1 copies San serif)
3c	60	ESC <	Select unidirectional mode (one line)

Table 3-10. Hex. Codes for ESC/P Commands (Continued)

Hex.	Dec.	ASCII	Command
3D	61	ESC =	Set MSB to 0
3E	62	ESC >	Set MSB to 1
3F	63	E S C ? s m	Reassign graphics mode
40	64	ESC @	Initialize printer
41	65	ESC A n	Set n/72-inch line spacing
42	66	ESC B nn	Set vertical tabs
43	67	ESC C n (0 n)	Set page length in lines (in inches)
44	68	ESC D nn	Set horizontal tabs
45	69	ESC E	Select emphasized mode
46	70	ESC F	Cancel emphasized mode
47	71	ESC G	Select double-strike mode
48	72	ESC H	Cancel double-strike mode
49	73	ESC I n	Printable code area expansion (codes 0 - 31 and 128 - 159, decimal:
4A	74	ESC J n	Perform line feed of n/216 inch
4B	75	ESC K nl n2	Select single-density graphics mode
4 c	76	ESC L nl n2	Select double-density graphics mode
4D	77	ESC M	Select 12 cpi
4E	78	ESC N n	Set skip over perforation
4F	79	ESC 0	Cancel skip over perforation
50	a0	ESC P	Select 10 cpi
51	81	ESC Q n	Set right margin
52	a2	ESC R n	Select international character set
53	83	ESC S 1/0	Select subscript/superscript mode
54	84	ESC T	Cancel subscript/superscript mode
55	85	ESC U 1/0	Turn unidirectional mode on/off
57	87	ESC W I/O	Turn double-width mode on/off
59	a9	ESC Y nl n2	Select high-speed double-density graphics mode
5A	90	ESC Z nl n2	Select quadrupledensity graphics mode
5 c	92	ESC \ nl n2	Set relative horizontal print position
5E	94	ESC ^ mn	Select O-pin graphics mode
61	97	ESC a n	Select justification
62	98	ESC b nn	Set vertical tabs in channels
6B	107	ESC k I/O	Select Sans serif/Roman typeface family
6 c	108	ESC l n	Set left margin
70	112	E S C p1 1 0	Turn proportional mode on/off
73	115	ESC s I/O	Turn half-speed mode on/off
74	116	ESC t n	Select character table
77	119	ESC w 1/0	Turn double-height mode on/off
78	120	ESC x 1/0	Select NLQ/draft
7F	127	DEL	Delete character

Hex Quick Reference Table for IBM Commands

Use the table below as an aid to read printer hex dumps. This table is for quick reference only. The user's guide contains a detailed description of the control codes.

Table 3-11. Hex. Codes for IBM Commands

Hex.	Dec.	ASCII	Command
07	07	BEL	Beeper
08	08	BS	Backspace
09	09	HT	Horizontal tab
OA	10	LF	Line feed
OB	11	VT	Vertical tab
o c	12	FF	Form feed
OD	13	CR	Carriige return
OE	14	s o	Select double-width mode (one line)
OF	15	SI	Select condensed mode
11	17	DC1	Select printer
12	18	DC2	Select 10 pitch
14	20	DC4	Cancel double-width mode (one line)
18	24	CAN	Cancel line
2D	45	ESC - I/O	Turn underlining on/off
30	48	ESC 0	Select 1/8-inch line spacing
31	49	ESC 1	Select 7/72-inch line spacing
32	50	ESC 2	Select ESC A line spacing
33	51	ESC 3 n	Set n/216-inch line spacing
34	52	ESC 4	Set top-of-form
35	53	ESC 5 I/O	Set/reset automatic line feed
36	54	ESC 6	Enable printable characters
37	55	ESC 7	Enable upper control codes
3A	58	ESC :	Select 12 pitch
3D	61	ESC = nn	Define user-defined characters
41	65	ESC A n	Set n/72-inch line spacing
42	66	ESC B nn	Set vertical tabs
43	67	ESC C n (0 n)	Set page length in lines (in inches)
44	68	ESC D nn	Set horizontal tabs
45	69	ESC E	Select emphasized mode
46	70	ESC F	Cancel emphasized mode
47	71	ESC G	Select double-strike mode
48	72	ESC H	Cancel double-strike mode
49	73	ESC I n	Select font
4A	74	ESC J n	Perform line feed of n/216 inch
4B	75	ESC K nI n2	Select single-density graphics mode
4 c	76	ESC L nI n2	Select double-density graphics mode

Table 3-11. Hex. Codes for IBM Commands (Continued)

Hex.	Dec.	ASCII	Command
4E	78	ESC N n	Set skip over perforation
4F	79	ESC 0	Cancel skip over perforation
50	80	ESC P 1/0	Turn proportional mode on/off
51	81	ESC Q n	Deselect printer
52	82	ESC R	Reset all tabs
53	83	ESC S I/O	Select subscript/superscript mode
54	a4	ESC T	Cancel subscript/superscript mode
55	a5	ESC U 1/0	Turn unidirectional mode on/off
57	a7	ESC W 1/0	Turn double-width mode on/off
58	88	ESC X n1 n2	Set left and right margins
59	89	ESC Y nl n2	Select high-speed double-density graphics mode
5A	90	ESC Z nl n2	Select quadruple-density graphics mode
5B 40	91 64	ESC [@ nn	Select double-height, double-width mode
5c	92	ESC \ nl n2	Print characters from symbol set
5E	94	ESC ^	Print one character from symbol set
5F	95	ESC_ 1/0	Turn overscoring mode on/off

Chapter 4

Disassembly and Assembly

List of Figures

List of Tables

Disassembly and Assembly 4

This section provides information you need to know to disassemble or assemble the printer.

Precautions

Read the precautions below before you disassemble or assemble the printer.

WARNING

Before disassembling, assembling, or adjusting the printer, disconnect the power supply cable from the AC power outlet. Failure to do so may cause physical injury. The power switch is wired in the secondary circuitry. Therefore, the printer's primary circuitry remains live even after the power switch is turned off.

CAUTION

To maintain optimum printer operation, use only the recommended tools for maintenance work. Also, use only the lubricants recommended in Chapter 5. Adjust the printer only as described in this manual. (See Chapter 5.)

Tools

Tables 4-1 and 4-2 list the recommended tools needed to disassemble, assemble, or adjust the printer. Use only tools that meet these specifications.

Table 4-1. Recommended Tools

Tool	Part No.
Round-nose pliers	8740400100
Nippers	B740500100
Tweezers	B741000100
Soldering iron	B740200100
E-ring holder #2.5	B740800400
Phillips screwdriver no. 2	B743800200
Flatblade screwdriver	B743000100
Thickness gauge	- -

Notes: 1. All the tools in the table above are commercially available.
2. Removing the power supply also requires the special tool shown on page 4-24.

Table 4-2. Equipment Required for Maintenance

Description	Specification
Multimeter	
Oscilloscope	20 MHz

Service Checks After Repair

Before you send the printer back to the customer, fill in the checklist in Table 4-3 to note the current state of the components. This checklist facilitates servicing and shipping.

Table 4-3. Inspection Checklist for Repaired Printer

Category	Component	items to Check	Is Check Requlred?
Printer features	Printhead	Are any wires broken?	❑ Checked, ☐ Not necessary
		Are any wires worn out?	☐ Checked, ☐ Not necessary
	Carriage mechanism	Does the carriage move smoothly? ☐ Movement noisy, ☐ Mechanism dirty, ☐ Mechanism oily	❑ Checked, ☐ Not necessary
		Is the carriage motor at the correct temperature and not overheating?	❑ Checked, ☐ Not necessary
	Paper advance mechanism	Is paper advancing smoothly? ☐ Movement noisy, ☐ Mechanism dirty, ☐ Mechanism oily	☐ Checked, ☐ Not necessary
		Is the paper feed motor running at the correct temperature and not overheating?	☐ Checked, ☐ Not necessary
	Paper path	Is the type of paper in the printer feeding smoothly?	☐ Checked, ☐ Not necessary
		Is the tractor feeding the paper correctly?	☐ Checked, ☐ Not necessary
		Is the paper path clear of all obstructions?	☐ Checked, ☐ Not necessary
		Is the platen free of damage?	☐ Checked, ☐ Not necessary
	Ribbon mask	Is ribbon mask free of distortion?	☐ Checked, ☐ Not necessary
	Self-print test	Was the self-print successful?	☐ Checked, ☐ Not necessary
	On-line test	Was the on-line test successful?	☐ Checked, ☐ Not necessary
Adjustment	Printhead	Is the platen gap adjusted correctly?	☐ Checked, ☐ Not necessary
	Printing	Is the bidirectional alignment adjusted correctly?	☐ Checked, ☐ Not necessary
System upgrade	ROM version	The ROM version is XXX.	❑ Checked, ☐ Not necessary
	Shipment	Has the ribbon been removed?	☐ Checked, ☐ Not necessary
		Have all the required parts been included in the shipment?	☐ Checked, ☐ Not necessary

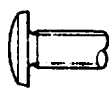
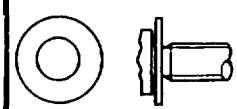
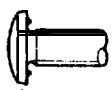
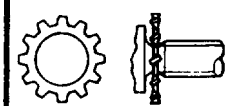
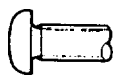
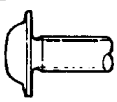
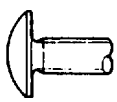
Screw Specifications

This chapter uses abbreviations for small parts, such as screws and washers. Tables 4-4 and 45 list these abbreviations.

Table 4-4. Abbreviations Used for Screws

Abbreviation	Part Name
CBB	Cross-recessed Bind head B tight screw
CBC	Cross-recessed Bind head C tight screw
CBN	Cross-recessed Bind head N tight screw
CBS	Cross-recessed Bind head S tight screw

Table 4-5. Screw Types and Abbreviations

Head		Body	Washer (assembled)
Top	Side		
.Cross-recessed head	1. Bind	1. Normal	1. Plain washer
			
		2. S-tight	
2. Slotted head	(with Notch)		2. Outside toothed lock washer
	2. Pan	3. B-tight	
			
	3. Cup	4. Tapping	3. Spring washer
			
	4. Truss		
			

Notes for Unit Removal and Installation

This section describes the procedures for disassembling and assembling the main components of the printer. Generally, you can install a component in the printer simply by reversing the procedure for removing the component. Therefore, this chapter does not describe assembly procedures in most cases. If necessary, special notes on assembling or adjusting a component are given at the end of the description of each procedure. Be sure to follow the instructions in these notes.

WARNING

Before disassembling, assembling, or adjusting the printer, disconnect the power supply cable from the AC power outlet. Failure to do so may cause physical injury. The power switch is wired in the secondary circuitry. Therefore, the printer's primary circuitry remains live even after the power switch is turned off.

CAUTION

Before disassembling any part of the printer, remove the paper and the ink ribbon. Also disconnect the interface cable.

Note: The flowchart below shows the order in which you need to disassemble the printer.

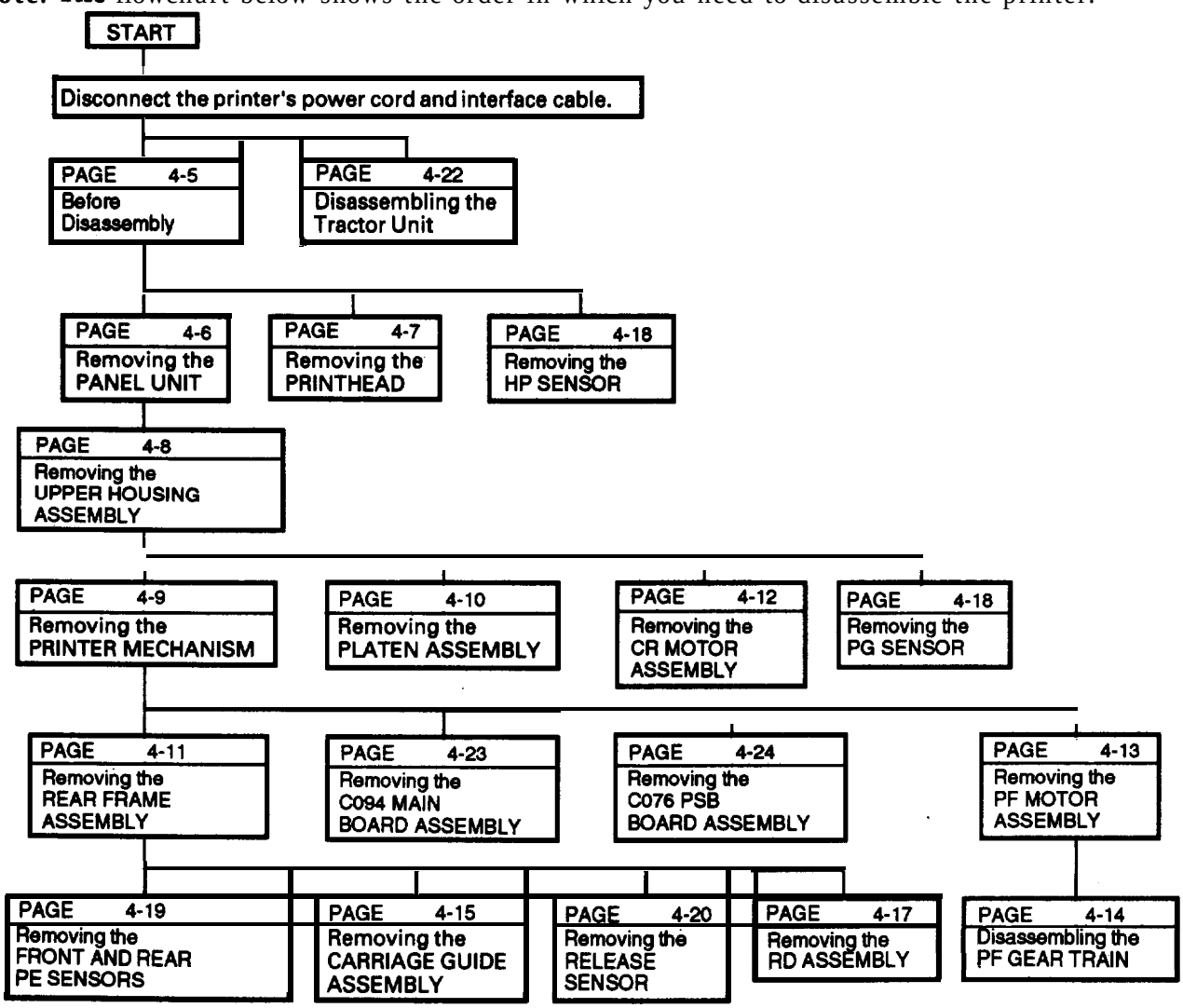


Figure 4-1. Flowchart for Disassembling the Printer

Items to Remove Before Disassembling the Printer

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit.

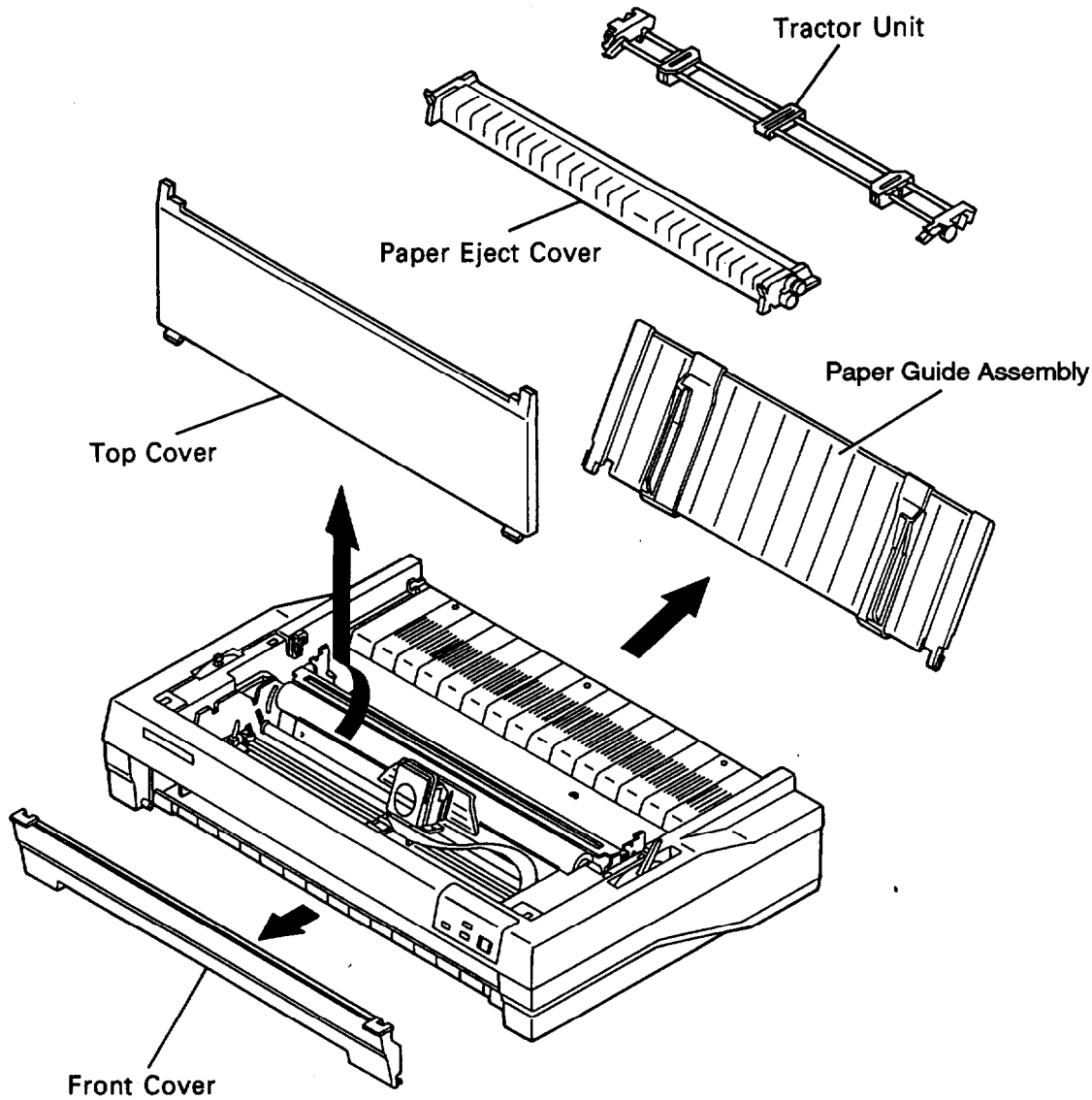


Figure 4-2. Removing the Paper Guide Assembly

Note: Remove the paper eject cover and the tractor unit by pushing and releasing the hooks at both sides. When remounting them, be sure to snap these hooks on the projecting parts.

Removing the Panel Unit

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover and tractor unit. (See page 4-5.)
2. Push the two clips on the bottom of the panel unit and remove the panel unit.
3. Remove the flexible flat cable (FFC).

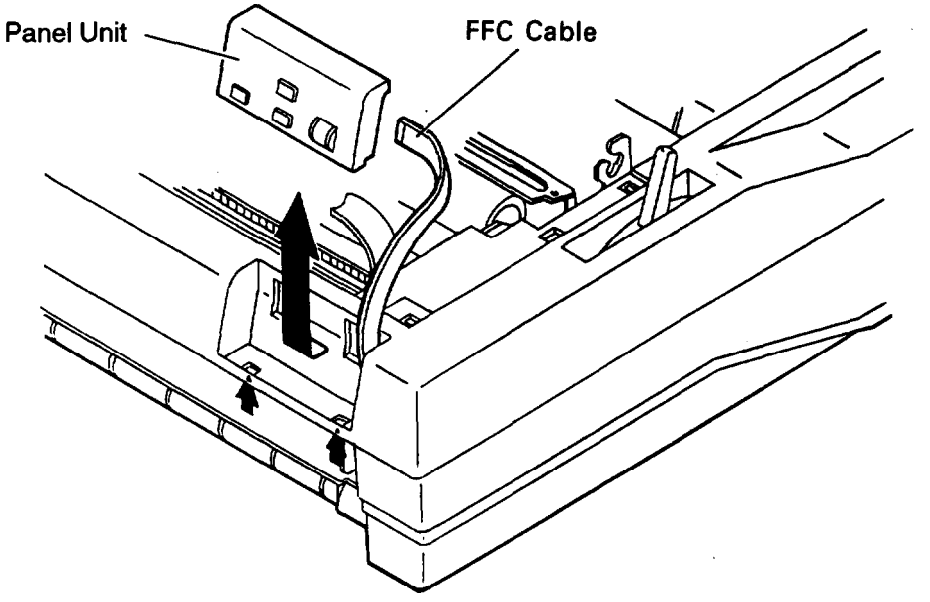


Figure 4-3. Removing the Panel Unit

Assembly Note

The FFC cable must be connected properly, as shown below.

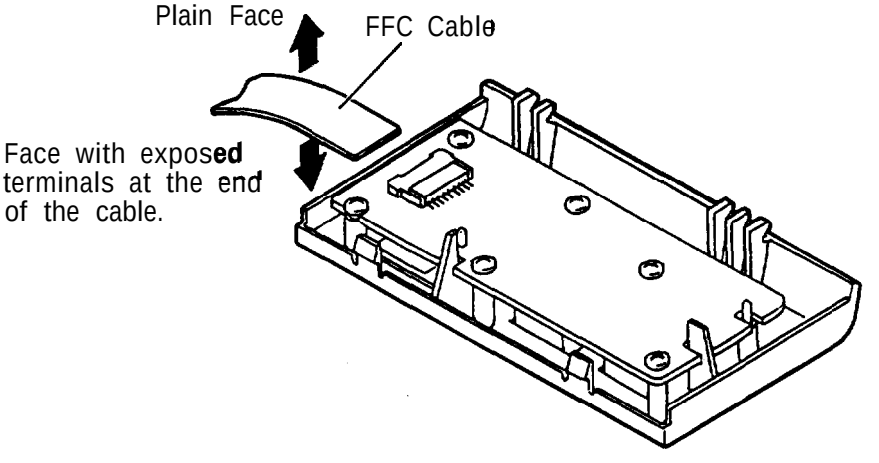


Figure 4-4. Connecting the FFC Cable to the Panel Unit

Removing the Printhead

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the two CBS (M3x8) screws from the printhead, lift the printhead up, and remove the FFC cable.
3. Remove the printhead.

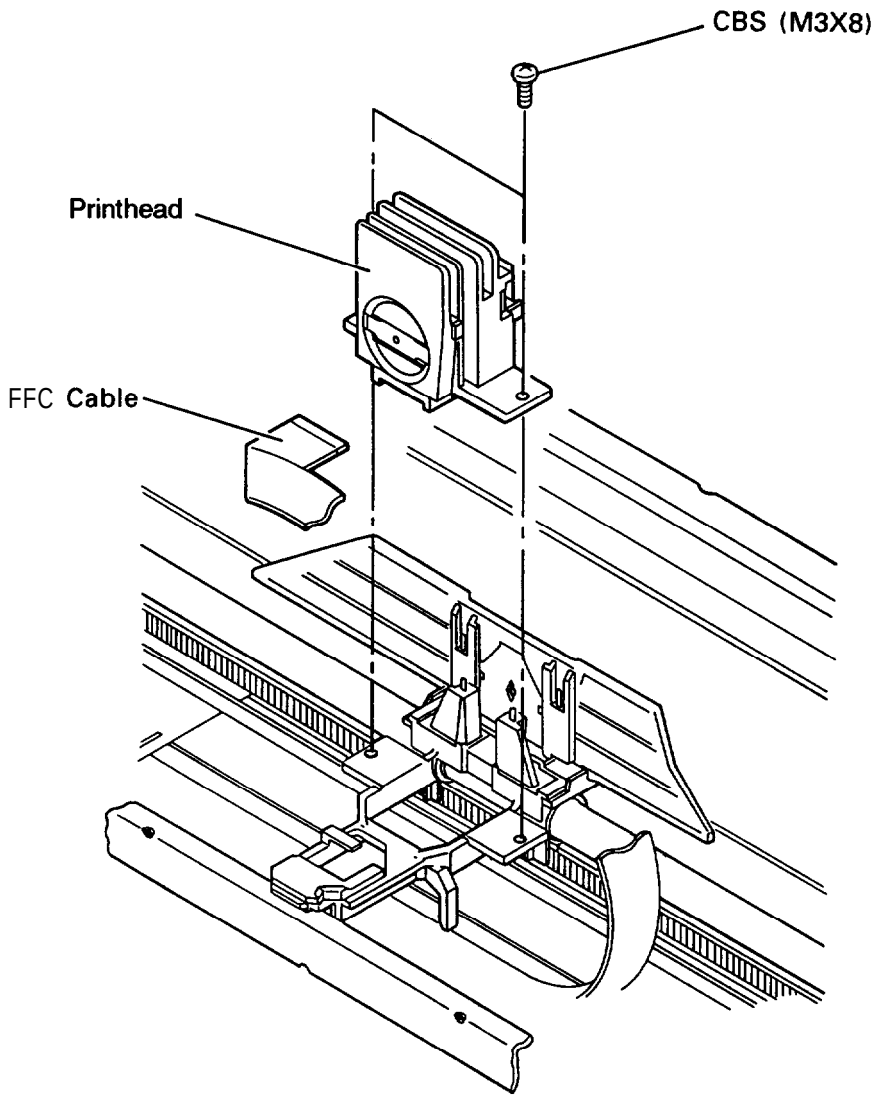


Figure 4-5. Removing the Printhead

Removing the Upper Housing Assembly

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the four CBC (M4x15) screws securing the upper housing assembly. (There are only three screws in the 80-column printer.)
4. Use a small screwdriver to push the two hooks through the cutouts, located on the front cover, to disengage the hooks from the plates. Lift up the front side of the upper housing assembly.
5. Remove the upper housing assembly.

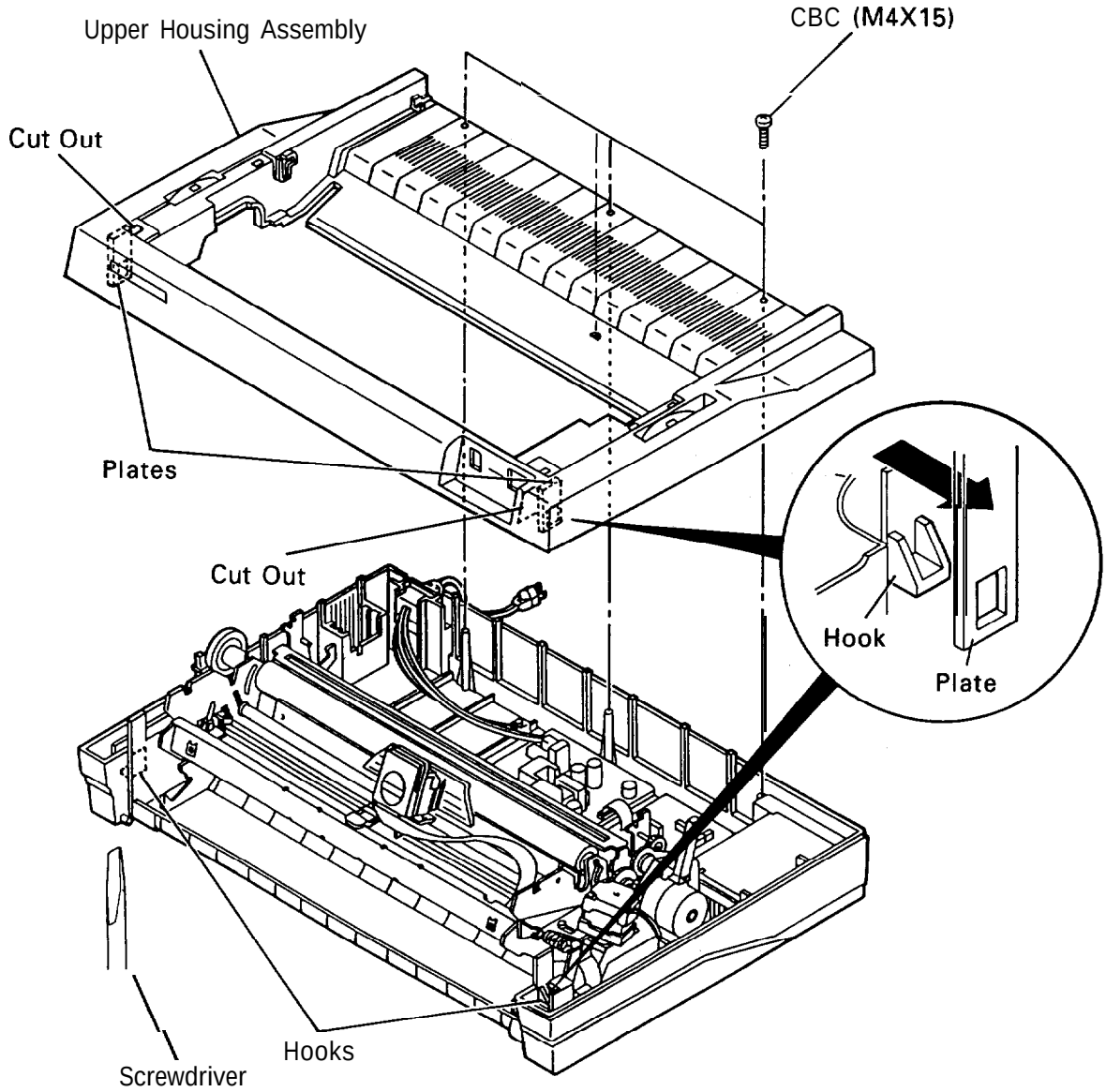


Figure 4-6. Removing the Upper Housing Assembly

Note: The figure above shows the 136-column printer.

Removing the Printer Mechanism

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 4-8.)
4. Remove the four CBB **(M4x12)** screws securing the printer mechanism.
5. Remove the CBS **(M3x6)** screw securing the interface cover.
6. Disconnect the following connectors on the MAIN board assembly: CN3 **(2-pin,** BLUE), CN4 **(2-pin,** WHITE), CN5 **(2-pin,** BLACK), CN6 **(6-pin,** BLACK), CN7 **(2-pin,** YELLOW), CN8 **(14-pin,** FFC cable), **CN9** (&pin, WHITE), CN12 (lo-pin, control panel), and CN13 **(5-pin,** WHITE).
7. Remove the printer mechanism.

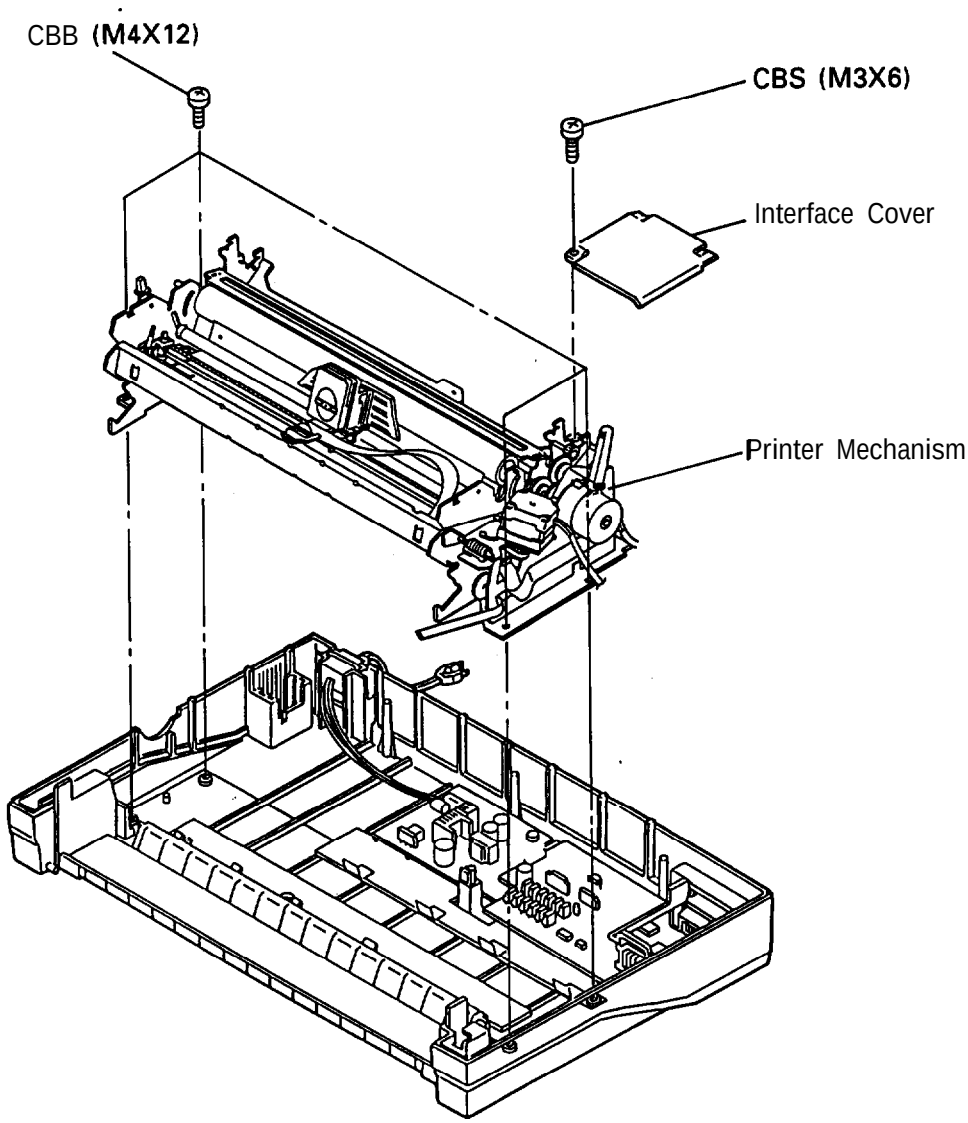


Figure 4-7. **Removing the Printer Mechanism**

Removing the Platen Assembly

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 4-8.)
4. Remove the two CBS **(M3x8)** screws securing the platen cover.
5. Disengage the teeth of the platen shaft holders and rotate them. Then slide the left platen **shaft** holder to the left.
6. Remove the platen knob.
7. Remove the ribbon mask by pushing the two clips.
8. Slide the platen assembly and remove it.

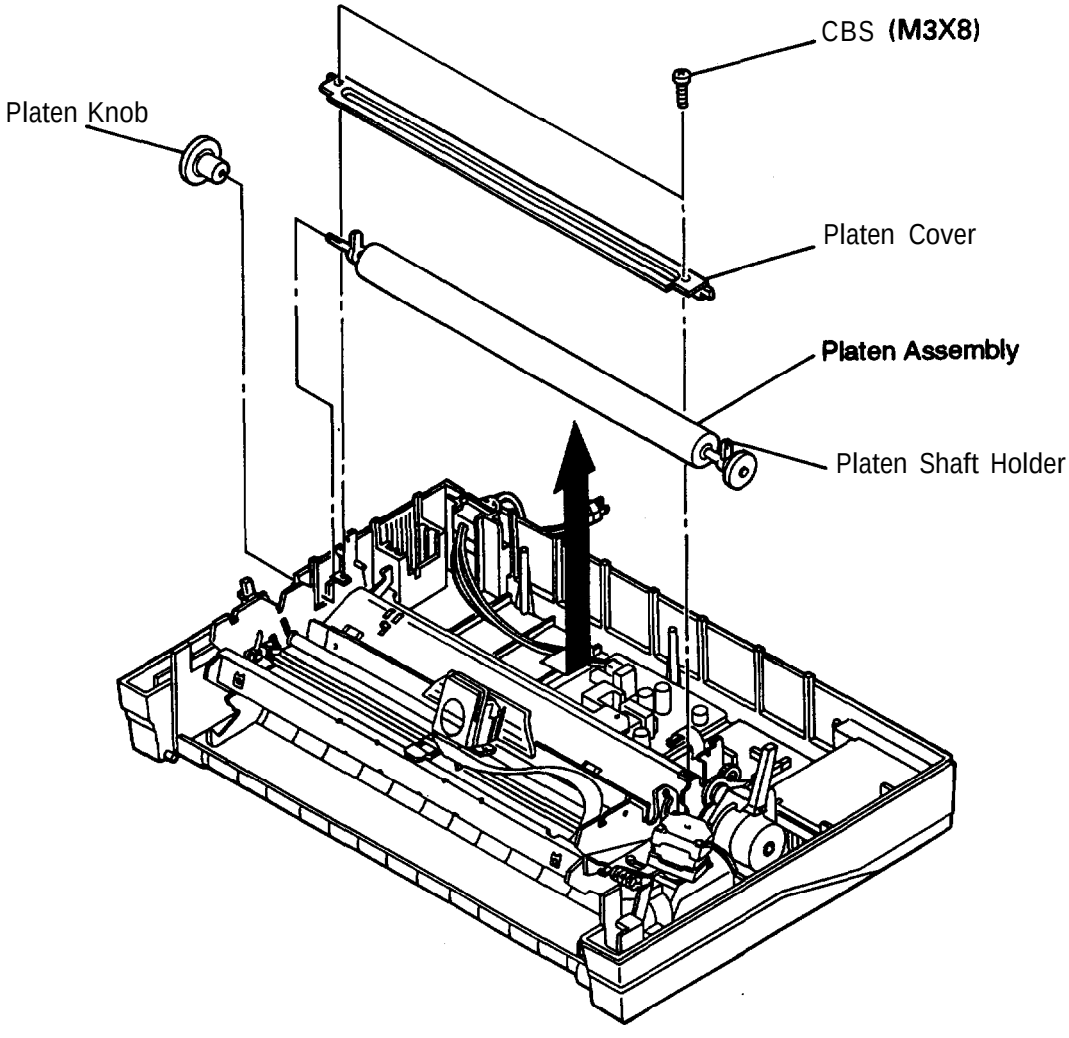


Figure 4-8. Removing the Platen Assembly

Removing the Rear Frame Assembly

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 4-8.)
4. Remove the printer mechanism. (See page 4-9.)
5. Remove the platen assembly. (See page 4-10.)
6. Remove the four CBS (M3x8) screws securing the left frame of the printer mechanism, and the nut and washer securing the adjust lever. Remove the parallelism adjustment bushing. Remove the left frame.
7. Remove the FFC cables from the right frame of the printer mechanism, and then the two CBS (M3x8) screws securing the right frame.
8. Remove the rear frame assembly.
9. Push the clip on the back of the rear frame assembly. Slide out the rear frame.

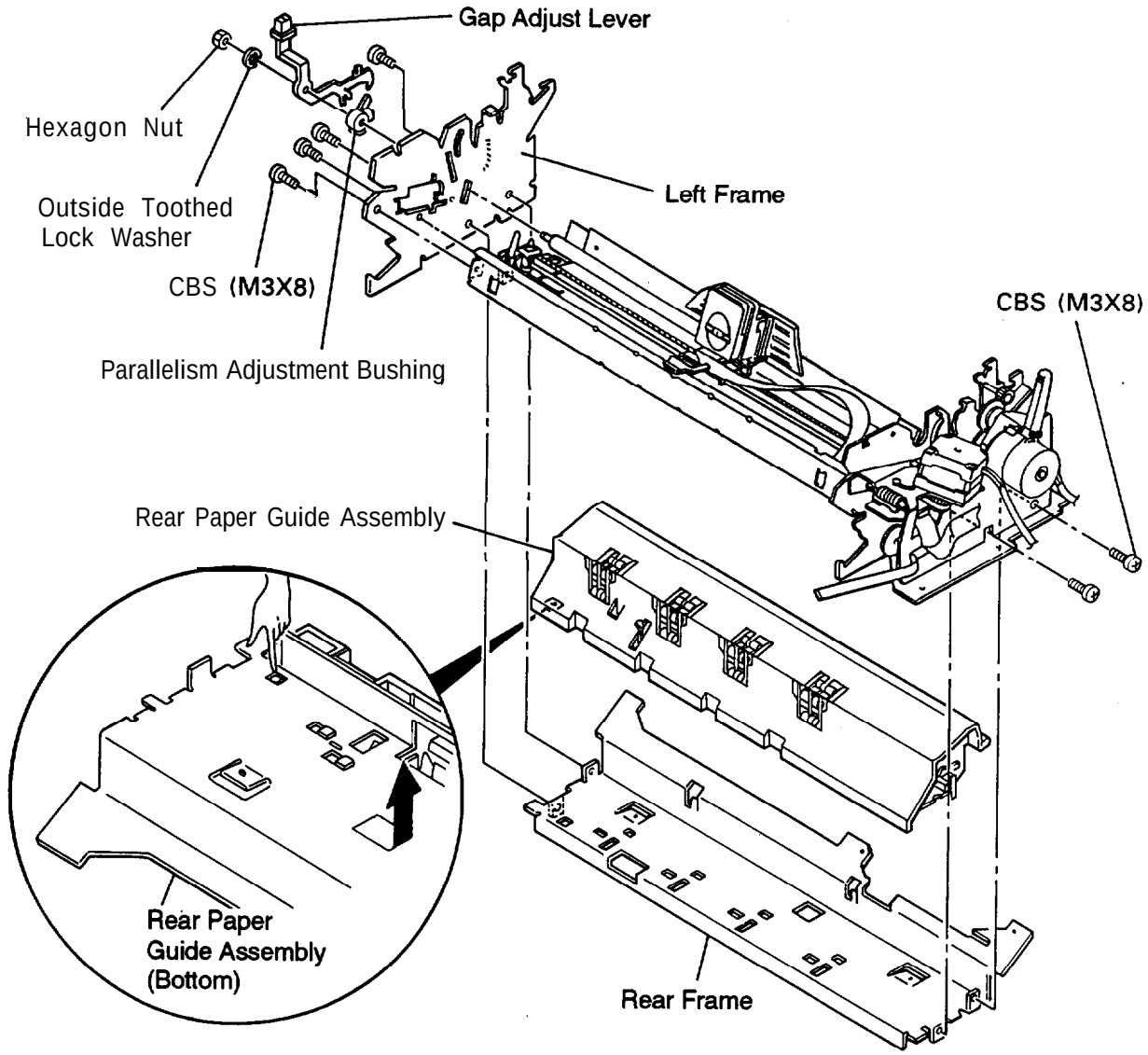


Figure 4-9. Removing the Rear Frame Assembly

Removing the CR Motor Assembly

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 4-8.)
4. Remove the face screw (M3x7) securing the CR motor assembly. After releasing the tension spring, disengage the timing belt from the CR motor assembly and hang it on the hook.
5. Disconnect connector CN13 on the C094 MAIN board assembly. Remove the CR motor assembly.
6. Remove the two CBN (M3x6) screws on the back of the CR motor assembly. Remove the CR motor assembly.

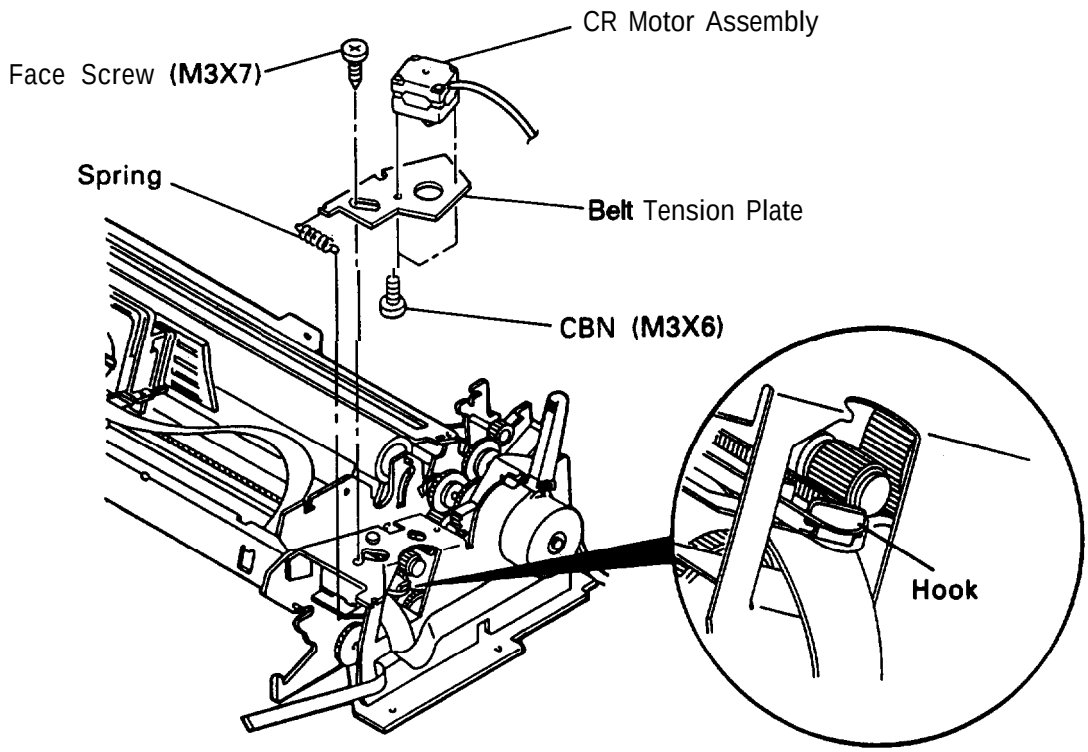


Figure 4-10. Removing the CR Motor Assembly

Assembly Note

Position the CR motor assembly on the belt tension plate correctly as shown below.

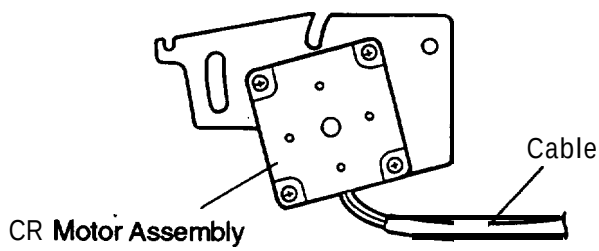


Figure 4-11. Positioning the CR Motor Assembly

Removing the PF Motor Assembly

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 4-8.)
4. Remove the printer mechanism. (See page 4-9.)
5. Set the release lever to the vertical or forward position.
6. Remove the FFC cables and then the two CBS(M3x8) screws securing the PF motor assembly.
7. Remove the PF motor assembly.

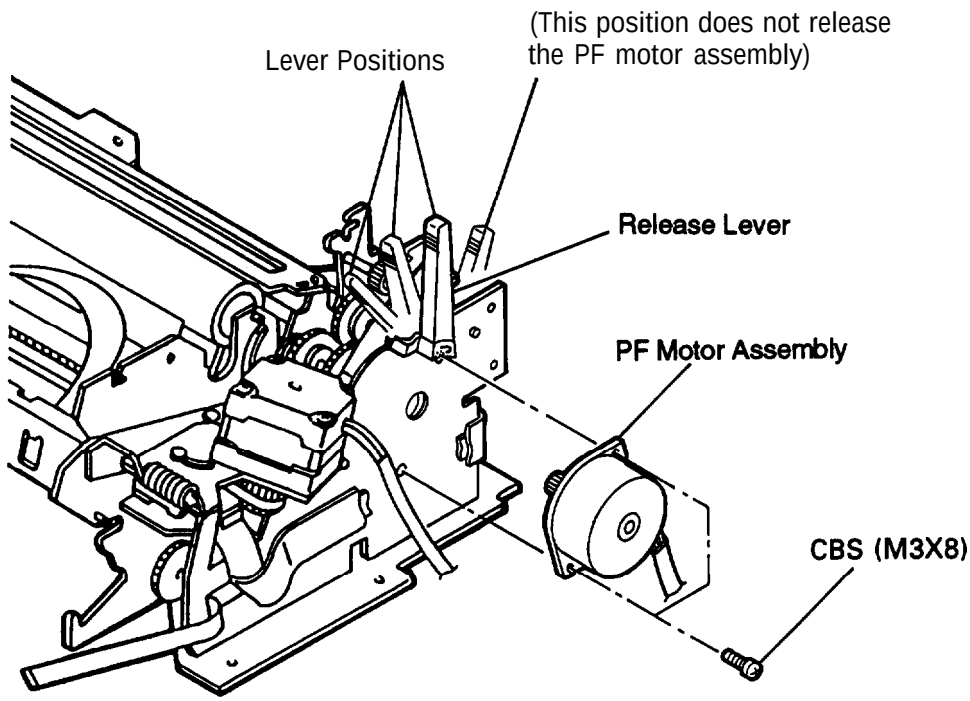


Figure 4-12. Removing the PF Motor Assembly

Disassembling the PF Gear Train

1. Remove the paper guide assembly, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 48.)
4. Remove the printer mechanism. (See page 4-Q.)
5. Remove the CR motor assembly. (See page 4-12.)
6. Remove the PF motor assembly. (See page 4-13.)
7. Remove the FFC cables from the right sub frame of the printer mechanism, and then remove the two CBS (M3x8) screws securing the right sub frame.
8. Remove the right sub frame.

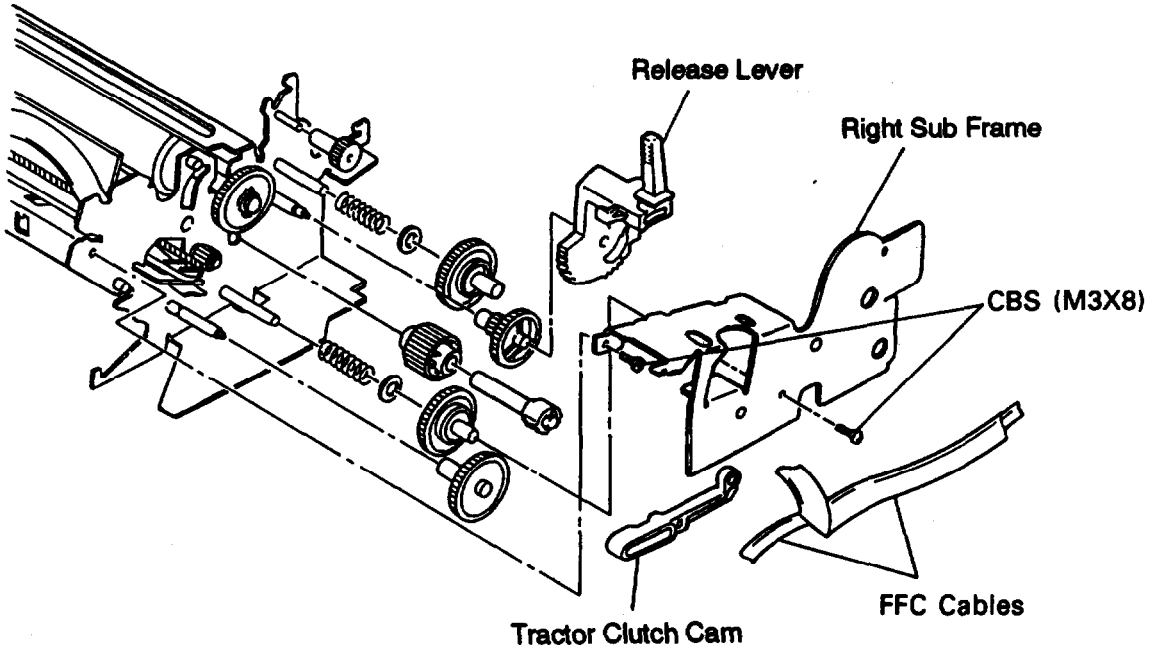


Figure 4-13. Disassembling the PF Gear Train

Assembly Note

Be sure to mesh the release lever with the mechanism properly.

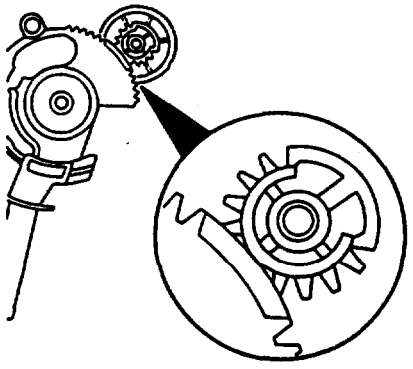


Figure 4-14. Positioning the Release Lever for Insertion

Removing the Carriage Assembly

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit, (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the printhead. (See page 4-7.)
4. Remove the upper housing assembly. (See page 4-8.)
5. Remove the printer mechanism. (See page 4-9.)
6. Remove the platen assembly. (See page 4-10.)
7. Remove the left frame of the printer mechanism. (See page 4-11.)
8. Disengage the timing belt from the CR motor assembly. (See page 4-12.)
9. Release the timing belt from the two clips at the bottom of the carriage assembly.
10. Move the carriage assembly to the CR motor assembly. Remove the carriage assembly from the rack.

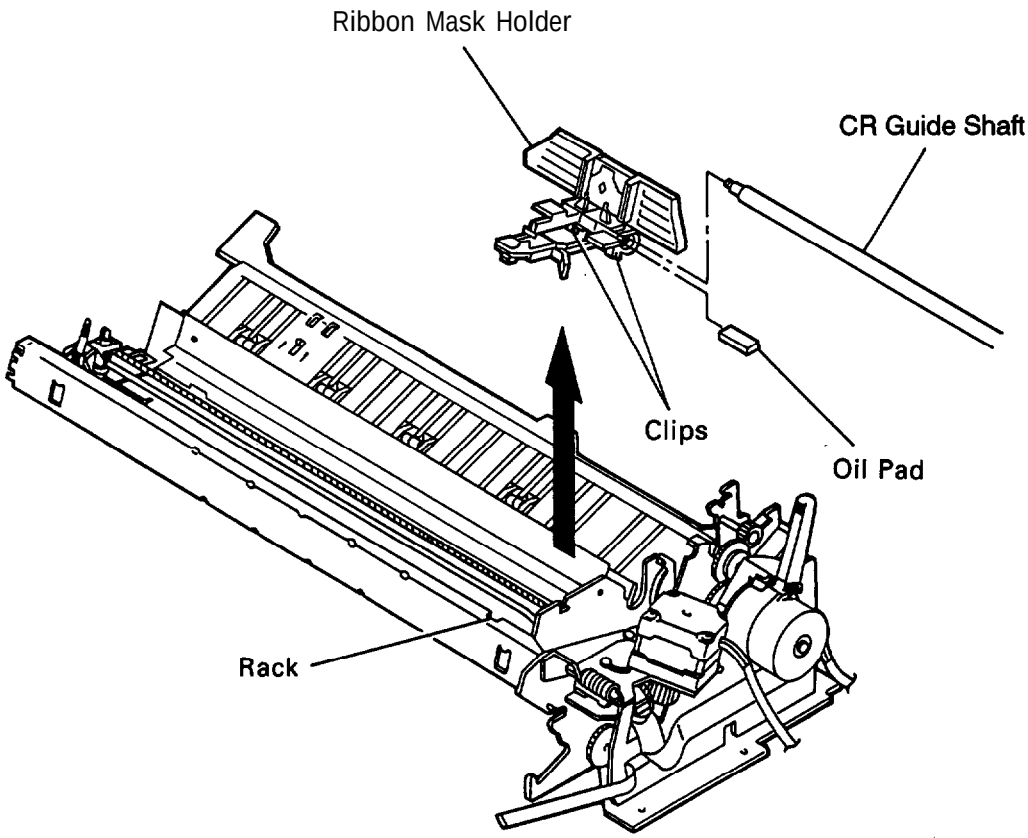


Figure 4-15. Removing the Carriage Assembly

Assembly Note

When attaching the timing belt to the carriage assembly, secure the timing belt using the left and right clips of the carriage assembly as shown below. Make sure there is no slack in the timing belt.

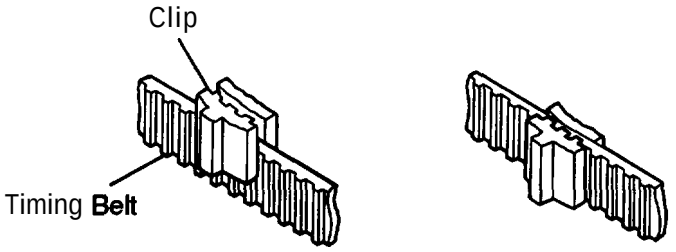


Figure 4-16. Attaching the Timing Belt

Removing the Ribbon Drive (RD) Assembly

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 4-8.)
4. Remove the printer mechanism. (See page 4-9.)
5. Remove the platen assembly. (See page 4-10.)
6. Remove the left frame of the printer mechanism. (See page 4-11.)
7. Disengage the timing belt from the CR motor assembly. (See page 4-12.)
8. Remove the carriage guide assembly. (See page 4-15.)
9. Remove the CBC (M3x8) screw and the CBB (M3x8) screw securing the RD assembly.
10. Remove the RD assembly.

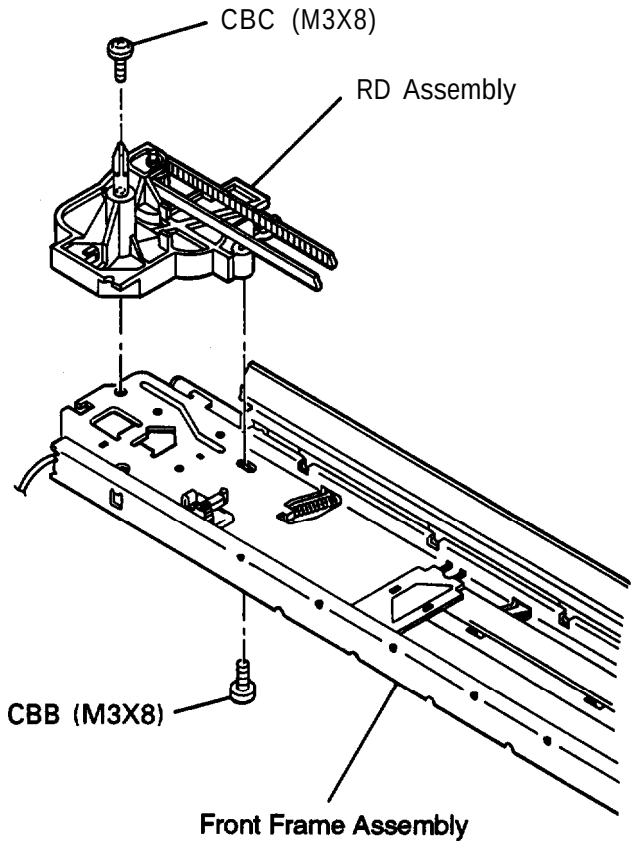


Figure 4-17. Removing the RD Assembly

Removing the Home Position (HP) Sensor

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the clip of the HP sensor. Remove the sensor.
3. Disconnect the HP lead from the HP sensor.

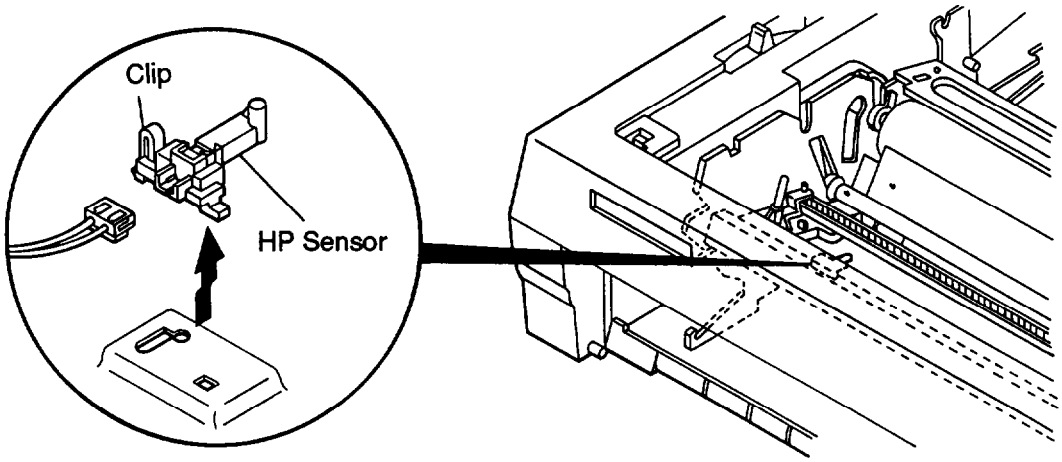


Figure 4-18. Removing the HP Sensor

Removing the Platen Gap (PG) Sensor

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 4-8.)
4. Remove the printer mechanism. (See page 4-9.)
5. Remove the two clips of the PG sensor attached to the left frame of the printer mechanism. Remove the sensor.
6. Disconnect the PG lead from the PG sensor.

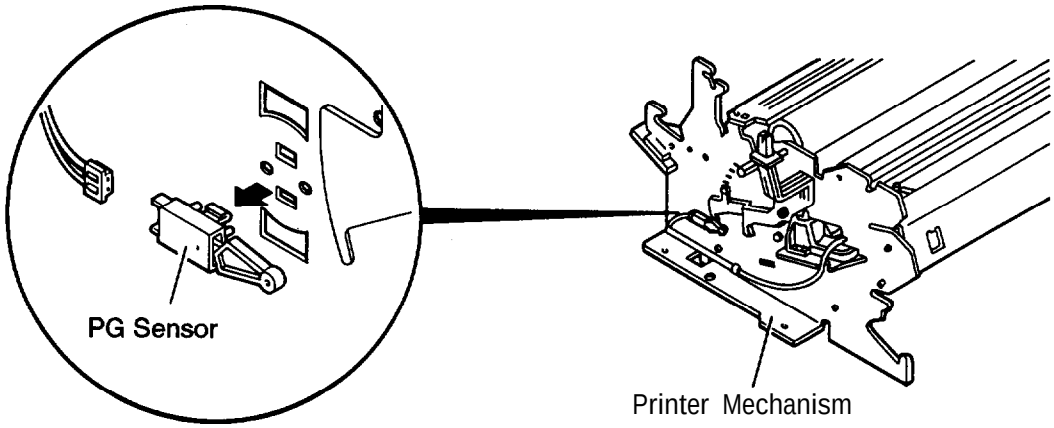


Figure 4-19. Removing the PG Sensor

Removing the Front and Rear Paper End (PE) Sensors

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 4-8.)
4. Remove the printer mechanism. (See page 4-9.)
5. Remove the platen assembly. (See page 4-10.)
6. Remove the rear frame assembly. (See page 4-11.)
7. Remove the clip for each PE sensor mounted on the rear paper guide assembly. Remove the front PE sensor and rear PE sensor.
8. Remove the lead from each PE sensor.

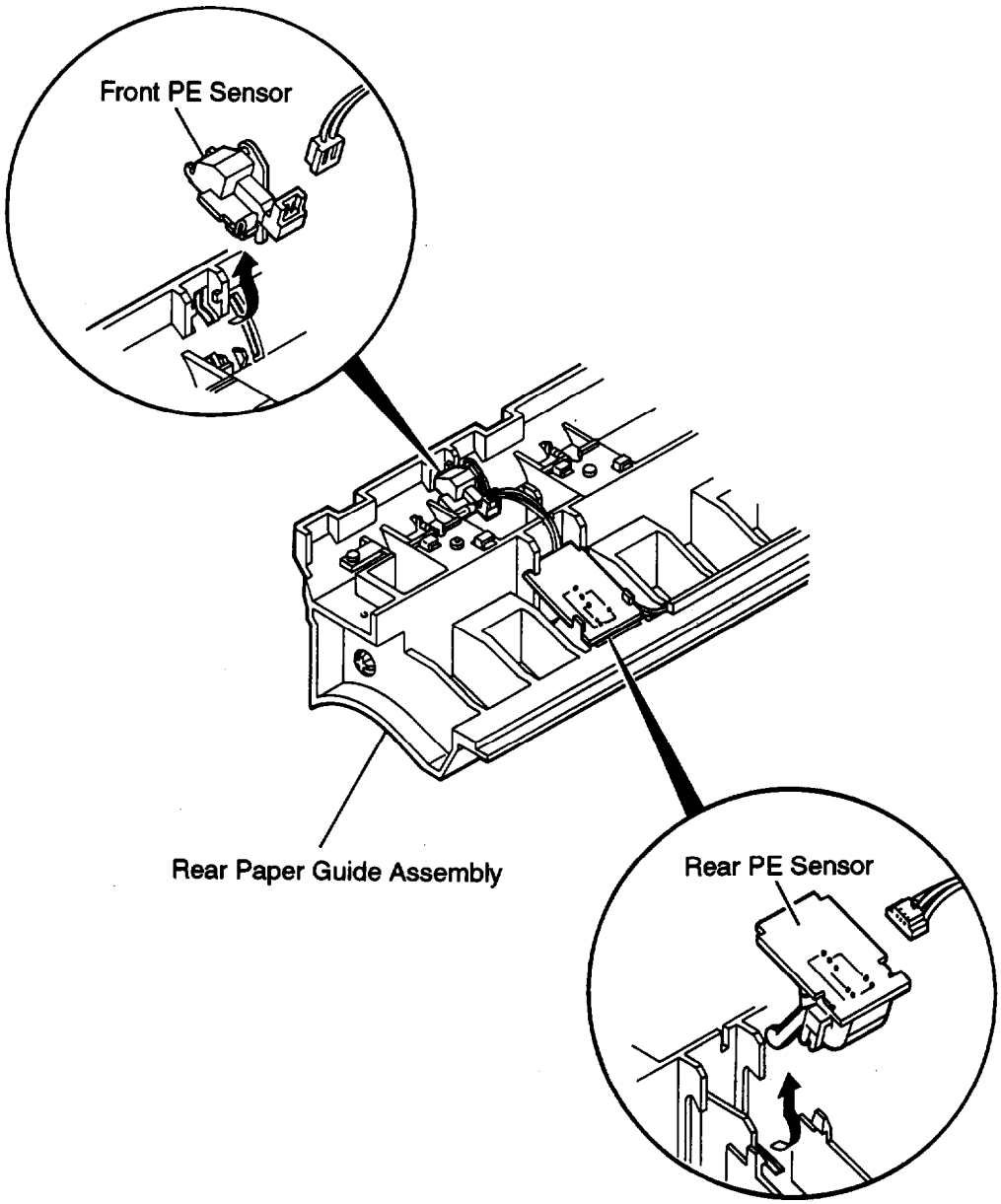


Figure 4-20. **Removing the PE Sensors**

Removing the Release Sensor

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 4-8.)
4. Remove the printer mechanism. (See page 4-9.)
5. Remove the platen assembly. (See page 4-10.)
6. Remove the rear frame assembly. (See page 4-11.)
7. Remove the two clips for the release sensor mounted on the rear paper guide assembly. Remove the release sensor.
8. Disconnect the release lead from the sensor.

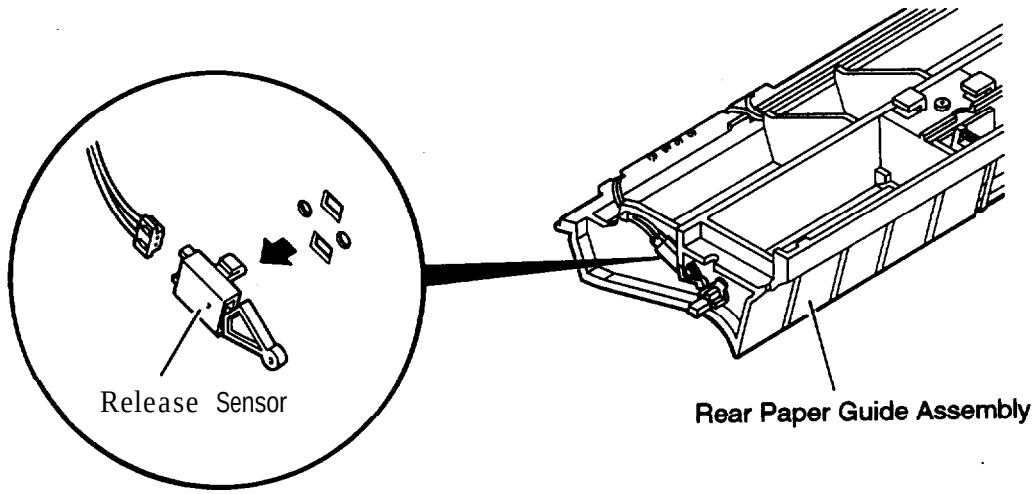


Figure 4-21. Removing the Release Sensor

Arranging the Cables

When you assemble the printer, arrange the cables as shown in Figure 4-22.

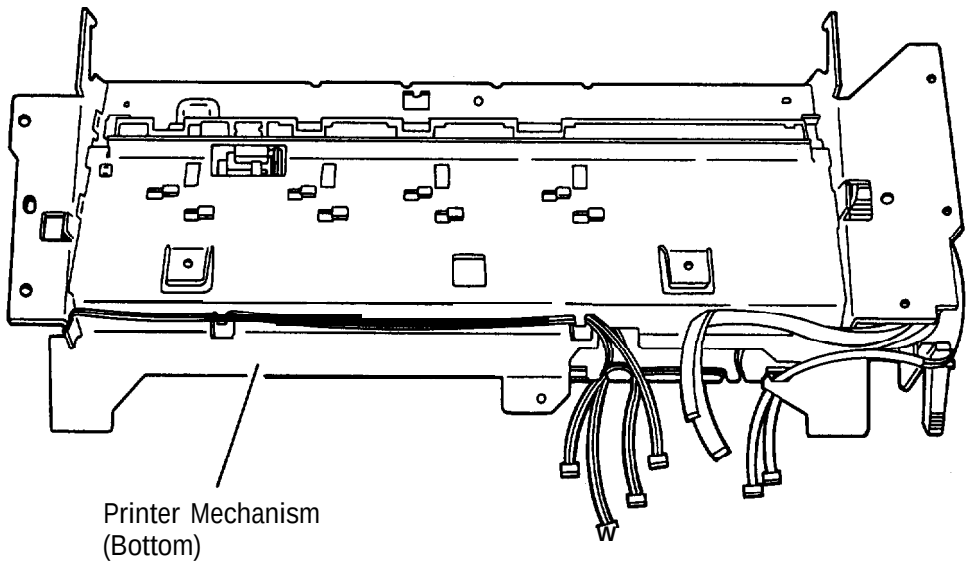


Figure 4-22. Arranging the Cables

Disassembling the Tractor Unit

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Release the two clips for cog (17) from the tractor shaft. Remove the cog.
3. Remove the right tractor frame from the tractor shaft and the tractor guide shaft.
4. Remove the E-ring from the tractor shaft.
5. Remove the right tractor, the paper support unit, and the left tractor from the tractor shaft and tractor guide shaft.

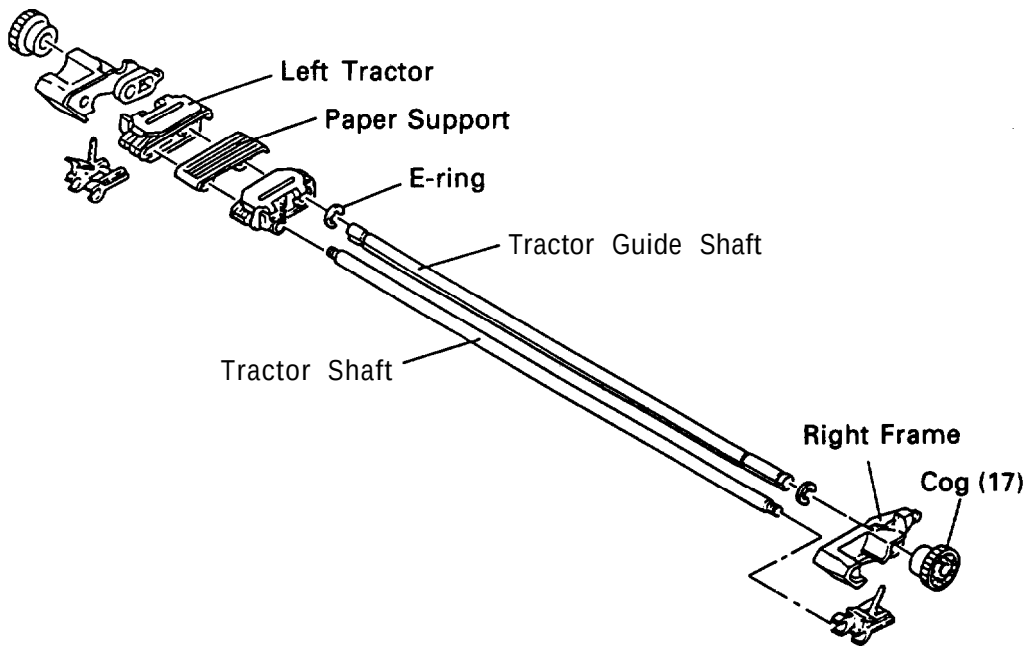


Figure 4-23. Disassembling the Tractor Unit

Assembly Note

When reassembling the tractor unit, be sure to snap the clips for cog (17) onto the tractor shaft.

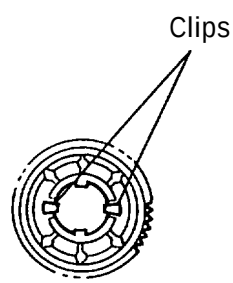


Figure 4-24. Position of the Cog

Removing the C094 MAIN Board Assembly

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 4-8.)
4. Remove the printer mechanism. (See page 4-9.)
5. Disconnect the cable from connector CN2 on the C076 PSB board assembly.
6. Remove I/F' support from the C094 MAIN board assembly.
7. Remove the two CBS (M3X12) screws securing the cover for the optional interface card.
8. Remove the CBC (M3X8) screw and the five CBB (M3X12) screws securing the C094 MAIN. board assembly. Remove the I/F' grounding plate.
9. Remove the C094 MAIN board assembly.

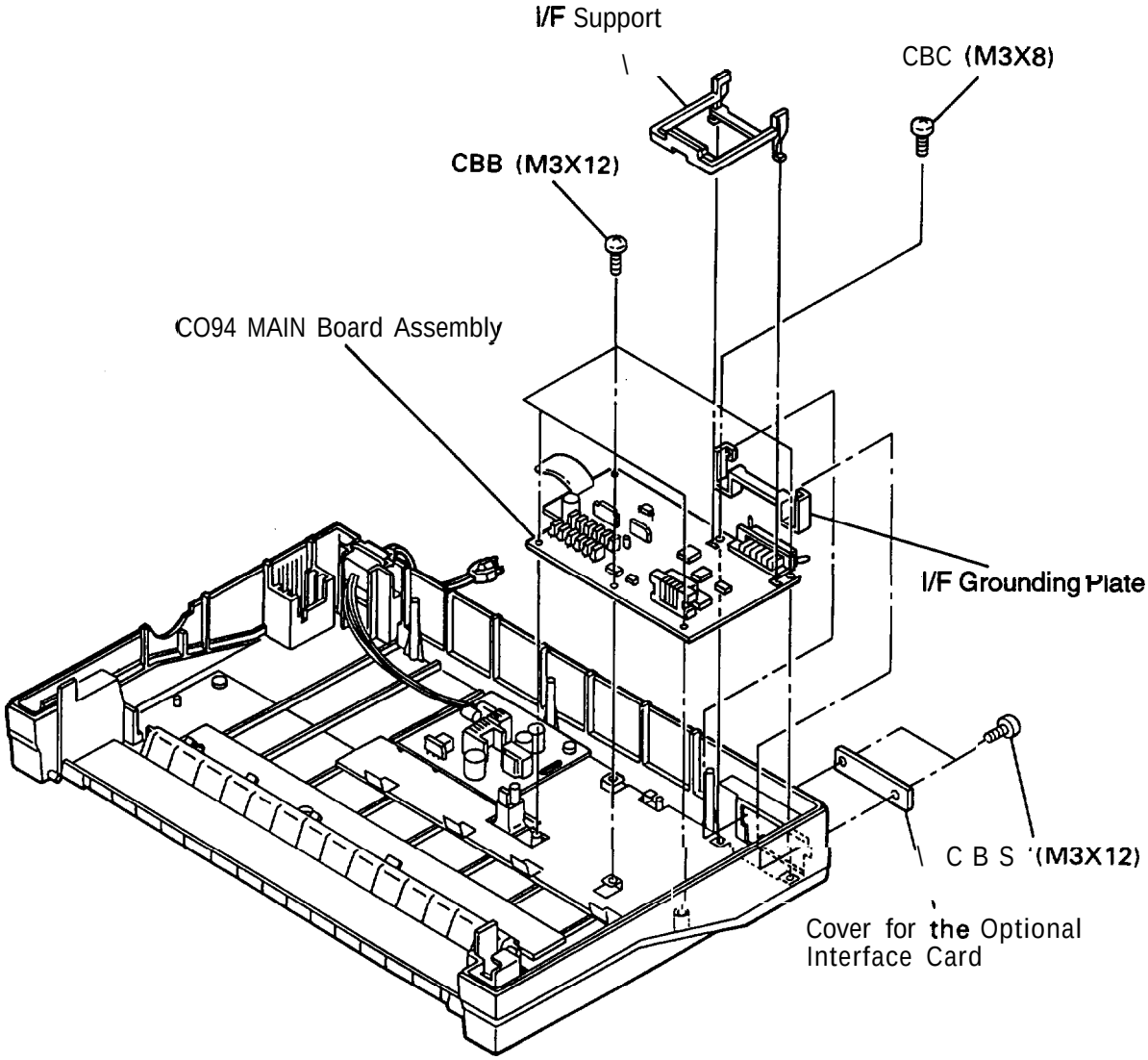


Figure 4-25. Removing the CO94 MAIN Board Assembly

Removing the C076 PSB Board Assembly

NOTE

To remove the C076 PSB board assembly for replacement, you must use a special extractor tool, available from Epson Parts Order Services. After obtaining the special tool shown, follow the procedure below.

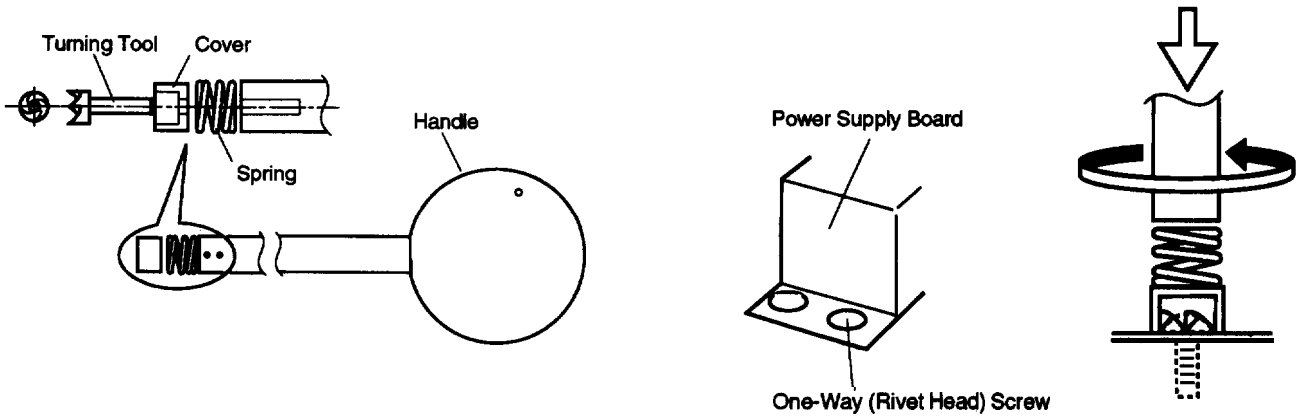


Figure 4-26. Special Extractor Tool

WARNING

Do not touch the heat sink attached to the FET (Q1) when the printer is powered on. If you touch the heat sink, you may suffer from electric shock.

1. Remove the paper guide assembly, ribbon, top cover, front cover, paper eject cover, and tractor unit. (See page 4-5.)
2. Remove the panel unit. (See page 4-6.)
3. Remove the upper housing assembly. (See page 4-8.)
4. Remove the printer mechanism. (See page 4-9.)
5. Remove the three CBB (M3x12) screws and the two CBC (M3x8) screws on the C076 PSB board assembly. Remove connectors CN1 (2-pin) and CN2 (11-pin).
6. Remove the C076 PSB board assembly.

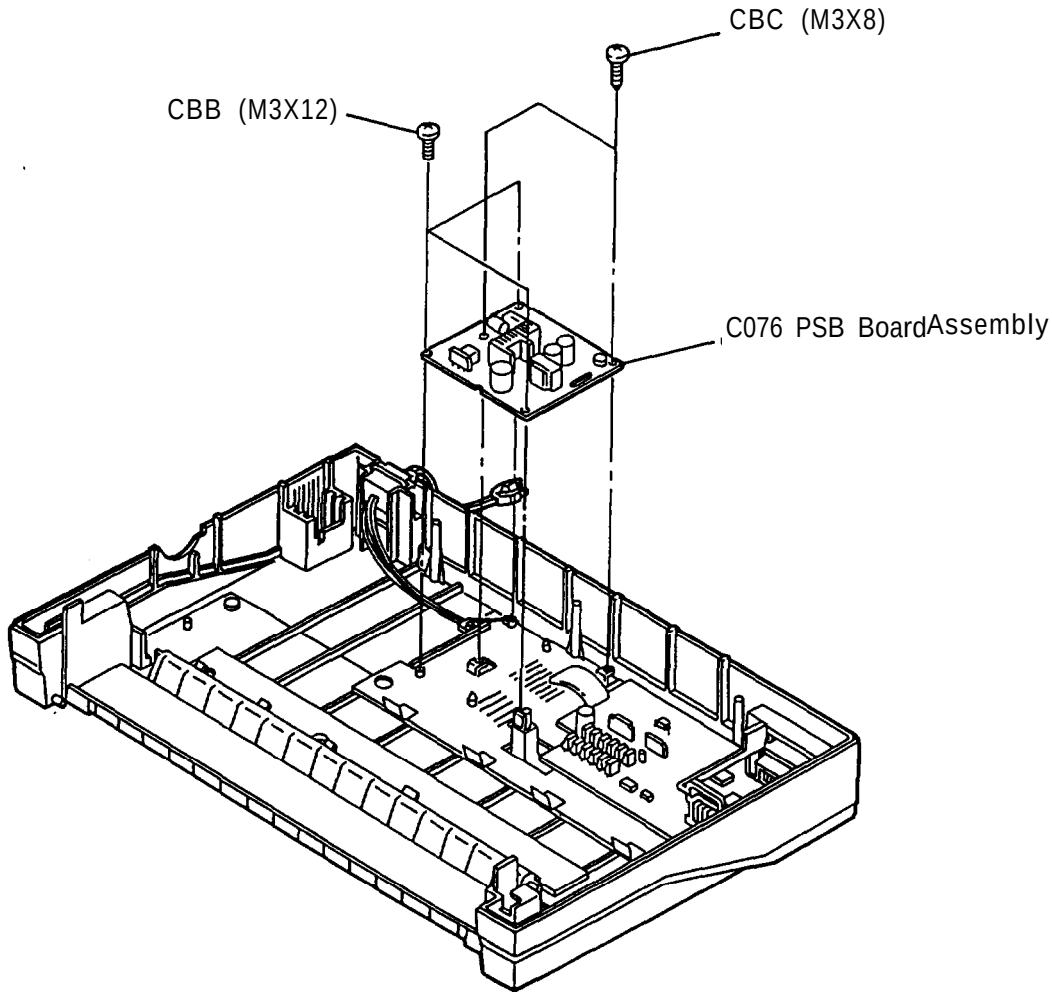


Figure 4-27. Removing the C076 PSB Board Assembly

Chapter 5

Adjustments, Maintenance, and Lubrication

List of Figures

List of Tables

Adjustments, Maintenance, and Lubrication 5

Adjusting the Printer Mechanism

This section describes the various adjustments required to keep the printer mechanism in optimum condition.

Platen Gap Adjustment

If you have changed the printhead, rotated or reassembled the carriage guide shaft, moved the parallelism adjustment bushing, or if printing is abnormal or ribbon tension is loose, you must adjust the gap between the platen and the printhead.

1. Remove the printer mechanism from the lower case. (See page 4-9.)
2. Remove the printhead from the carriage. (See page 4-7.)
3. Use tweezers to remove the ribbon mask from the carriage.

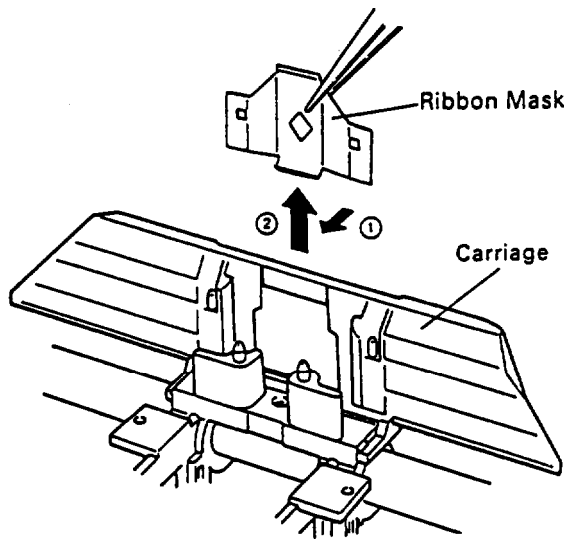


Figure 5-1. Removing the Ribbon Mask

4. Remount the printhead on the carriage.
5. Set the adjust lever to the 0 setting (second step position from the rear).
6. Move the release lever back to the FRICTION setting.
7. Move the carriage until the edge of the printhead is at the fifth column print position.
8. Use a box driver (7 mm) to rotate the parallelism adjustment bushing on the left frame of the printer mechanism.

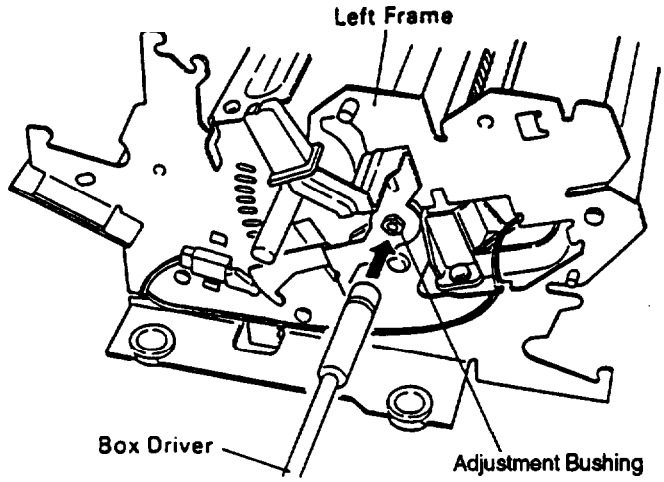


Figure 5-2. Parallelism Adjustment Bushing

9. Rotate the adjusting bushing until the platen gap is large enough for a 0.36 mm thickness gauge, but too narrow for a 0.40 mm thickness gauge.

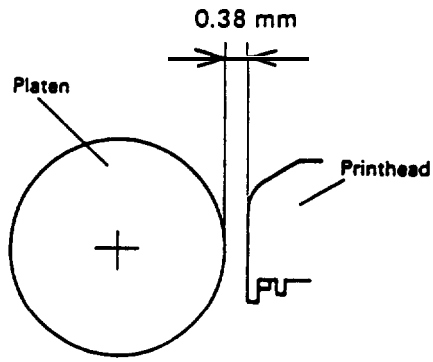


Figure 5-3. Platen Gap

10. Move the carriage until the edge of the printhead is at the 75th column print position for an 80-column printer or at the 130th column print position for a 136-column printer.
11. Use the 7 mm box driver to rotate the parallelism adjustment bushing on the right frame of the printer mechanism.
12. Rotate the adjustment bushing until the platen gap is large enough for a 0.36 mm thickness gauge but too narrow for a 0.40 mm thickness gauge.
13. Move the printhead back to the 5th column print position again. Check the platen gap with the thickness gauge. It should still be large enough for the 0.36 mm thickness gauge but too narrow for the 0.40 mm gauge. If this is not the case, go back to step 8.
14. Remove the printhead, install the ribbon mask, replace the printhead, and install the printer mechanism back in the case.

Bidirectional Alignment Adjustment

This section describes how to adjust the bidirectional print position to ensure correct printing.

Overview of the Bidirectional Alignment Adjustment

The FX-870/1170 prints characters when the carriage moves from both from left to right and from right to left. Therefore, the printing in one direction must be correctly aligned with the printing in the other direction. Otherwise, printed vertical lines may be staggered.

It is important to readjust the bidirectional alignment whenever anything has been done to the gear arrangement of the printer mechanism that might affect this alignment. The bidirectional alignment can be adjusted by altering the timing in which the carriage moves from one end to the other.

Since no two printer mechanisms are manufactured exactly the same, the bidirectional alignment correction differs for each printer. Also, the correction value must be written to each E^2PROM, and it must be rewritten after each adjustment.

Bidirectional Alignment Adjustment Procedure

The FX-870/1170 has a built-in bidirectional adjustment program. Follow the steps on the next page to adjust the bidirectional alignment.

Adjustment Operation

1. Turn on the printer's power while pressing the PAUSE, PAPER FEED, and FONT buttons simultaneously.
2. The printer enters draft mode and prints the current adjustment value and four lines of the H character. (See Figure 5-3.) If the vertical lines are well aligned, go to step 4. Otherwise, go to step 3.
3. Referring to the odd-numbered lines (1st and 3rd), adjust the even-numbered lines (2nd and 4th).
   - If the even-numbered lines are shifted to the right, press the FONT button to shift them to the left. The adjustment value increases by the shifted amount.
   - If the even-numbered lines are shifted to the left, press the PAPER FEED button to shift them to the right. The adjustment value decreases by the shifted amount.
4. Press the PAUSE/TEAR OFF button when you finish the draft mode adjustment.
5. The printer enters the NLQ mode and prints an adjustment value and four lines of the H character. (See Figure 5-4.) If the vertical lines are well aligned, go to step 7. Otherwise, go to step 6.
6. Follow the instructions in step 3.
7. Turn off the printer's power.

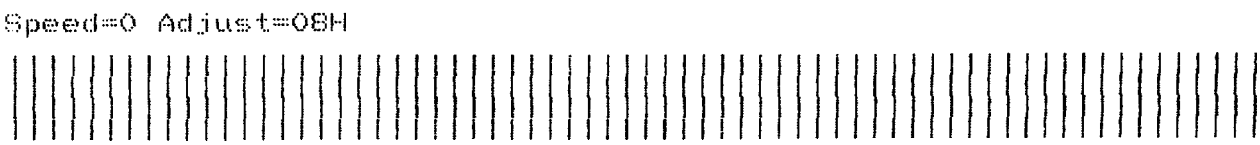


Figure 5-4. Bidirectional Alignment Adjustment (Draft Mode)

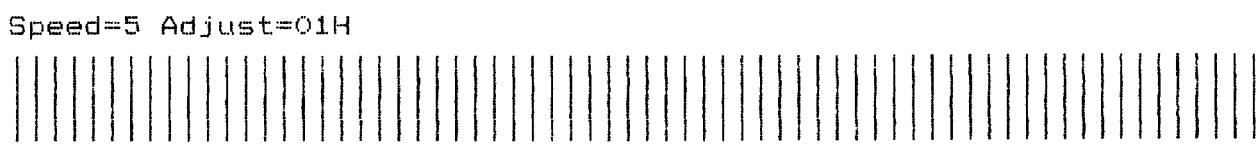


Figure 5-5. Bidirectional Alignment Adjustment (NLQ mode)

Preventive Maintenance

No preventive maintenance is required other than occasionally vacuuming the printer mechanism to remove dust and paper debris and regularly cleaning the case exterior with denatured alcohol. After cleaning the unit, check that it is properly lubricated as described under ***Lubrication,*** below. Also inspect the springs and rollers to see that they are operating properly.

CAUTION

Disconnect the printer from the external AC power source before performing maintenance work. Do not use thinner, trichloroethylene, or ketone-based solvents on the plastic components of the printer.

Lubrication

Epson recommends that the printer be lubricated at the points shown in Figure 5-2. Table 5-2 lists each lubrication point and its recommended lubricant. All the lubricants have been tested extensively and found to comply with the requirements of this printer. Table 5-1 describes the lubricants.

Before applying lubricant, be sure to clean the surface to be lubricated. Do not apply too much lubricant, or it may affect related parts.

Table 5-l. Lubricants

Lubricant	Type	Quantity	Availability	Part No.
Grease	G-26	40 mg	E	B702600001
Oil	o-2	40 cc	E	8703700001

Table 5-2. Lubrication Points

Ref. No.	Lubrication Points	Lubricant
1	Platen gap adjustment slots on the left frame (excluding the two slots **at the** bottom)	G-26
2	The arms and tab of the RD assembly	G-26
3	The shaft end of the drive roller assembly	G-26
4	The ribbon drive gear train	G-26
5	The oil pad in the carriage assembly	o-2
6	The cam surface of the tractor clutch cam	G-26
7	The cam end of spur gear 34.5	G-26

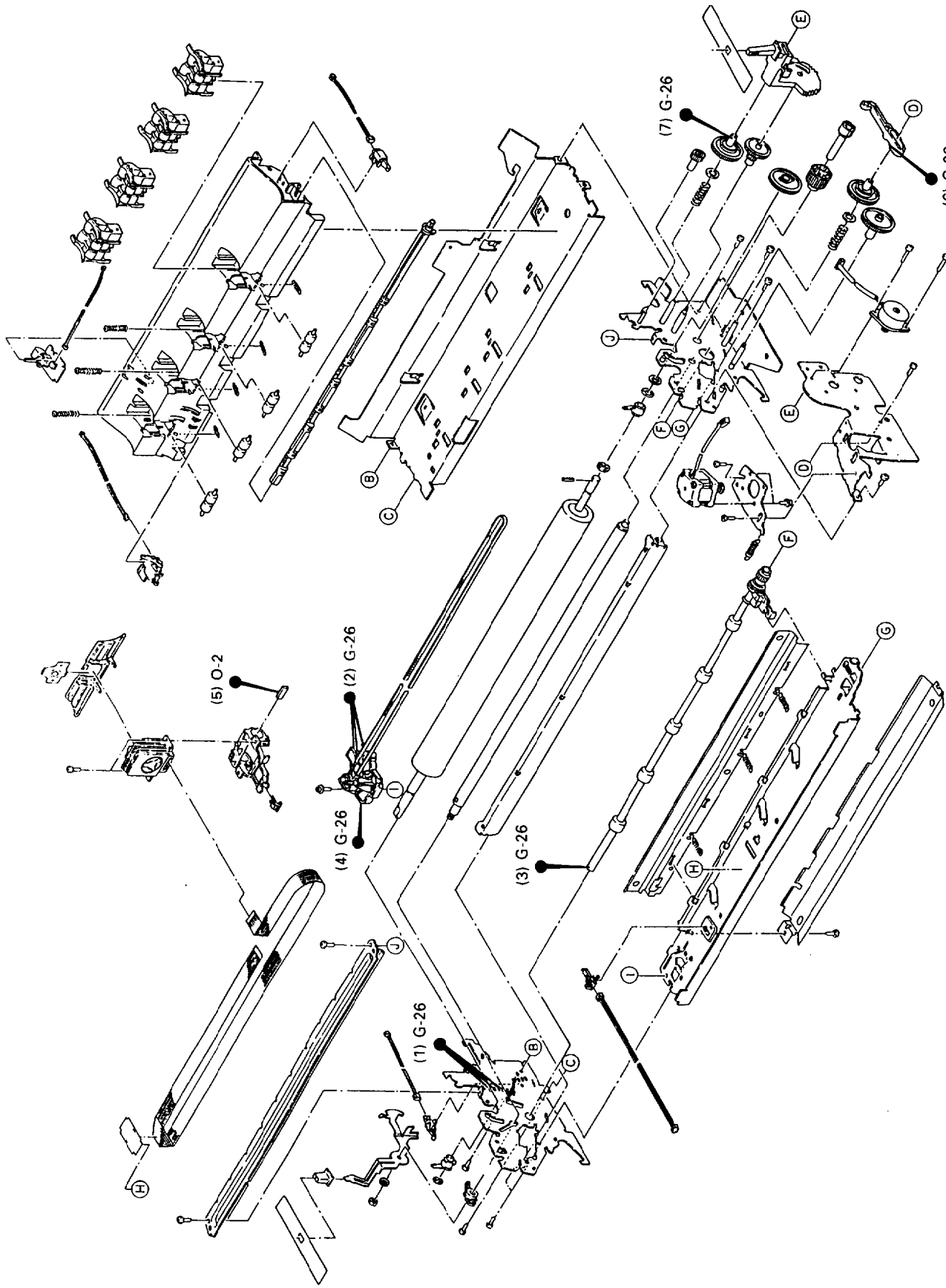


Figure 5-6. Lubrication Points

Chapter 6

Principles of Operation

List of Figures

List of Tables

Principles of Operation 6

This chapter explains the mechanical and electrical operations of the FX-870/1170. At the end of the chapter, there are tables for component-level diagnosis of the main logic board and the power supply board.

Printer Mechanism Operation

This section describes the FX-870/1170 printer mechanism and explains how the printer works. The FX-870/1170 printer mechanism features a 9-pin impact dot printhead for serial printing. It has four main parts:

- the printhead mechanism
- the carriage movement mechanism
- the paper feed mechanism
- the ribbon advance mechanism

Each of these is described below.

Printhead Mechanism

The printhead mechanism consists of the printhead itself, the ink ribbon, and the platen. The printhead contains a column of 9 wires. Each of these wires has a drive coil, which causes the wire to move in and out of the printhead to print each dot. The three steps below describe how these driving wires work.

1. The control circuit outputs drive signals to the printhead drive circuit. This changes the printhead drive voltage, and current flows through the corresponding printhead coil. The coil acts as a solenoid and generates a magnetic force.

2. This induced force causes the plate to approach the coil rod, and the associated dot wire is rapidly ejected to impact on the platen.

3. The dot wire presses the ink ribbon up against the paper as it hits the platen, and in this way, prints a dot on the paper.

4. As soon as the current through the coil is switched off, the force induced in the coil rod stops. The plate then returns to its original position (the position assumed before the coil was energized) through the action of the plate spring. After the dot wire hits the platen, the rebounding force of hitting the platen works with the wire resetting spring to pull the wire back to its original position.

Figure 6-1 shows the action of the printer mechanism when a single dot is printed.

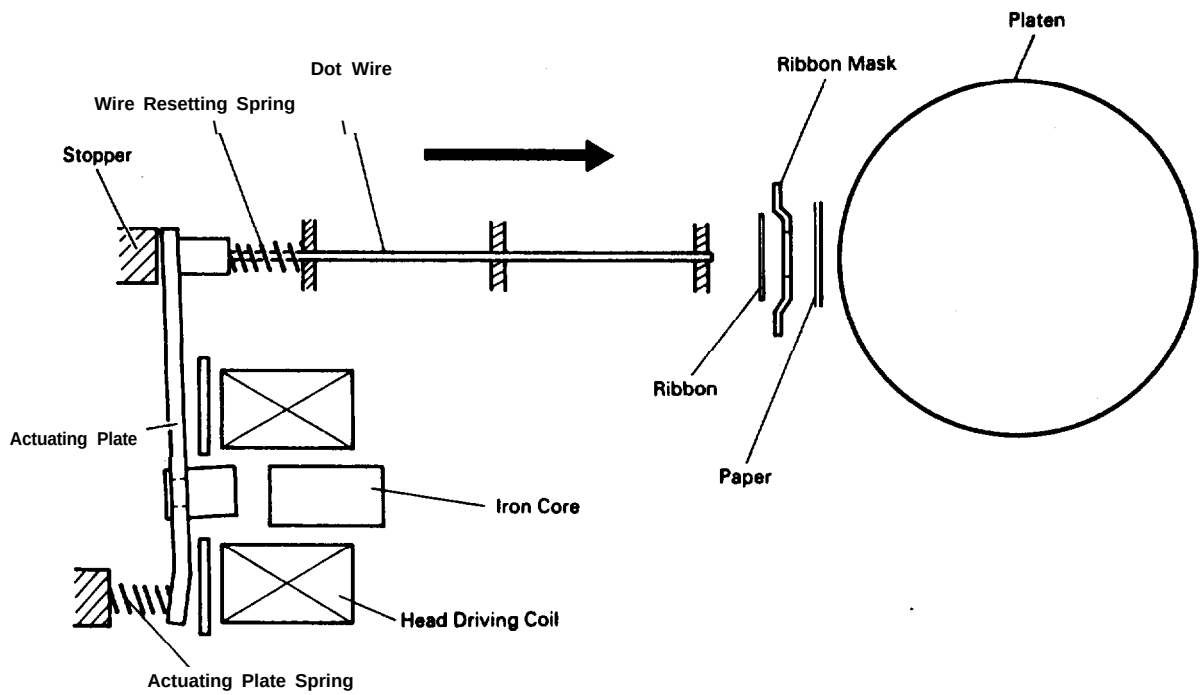


Figure 6-1. How the Printhead Works

The printhead tends to heat up after a period of continuous printing. To minimize the dot wire drive coil's overheating, the head is equipped with a thermistor that can detect the head temperature. When the thermistor detects changes in the printhead temperature, the voltage signal changes. The CPU detects the voltage change and stops printing until the head temperature cools.

The printhead is also used as a buzzer. Head driving coils move all the dot wires back and forth without impacting the platen, so that the wires vibrate. The vibrating dot wires sound like a buzzer.

Carriage Mechanism

The timing belt is connected to the lower side of the carriage. With the printhead installed, the carriage moves in either direction along the carriage guide shaft. The carriage (CR) motor, a stepping motor, drives the timing belt, which moves the carriage. The home position (HP) sensor detects the home position of the carriage.

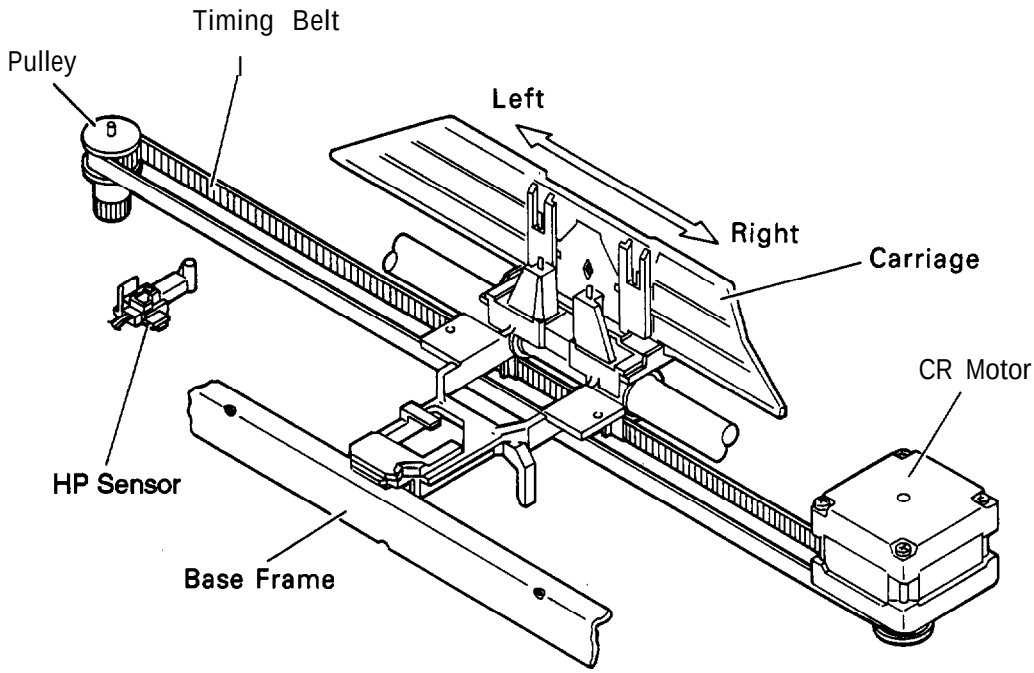


Figure 6-2. Carriage Operation

Platen Gap Adjustment

The platen gap (the gap between the platen and the printhead) can be adjusted to allow the printer to use paper of different weights or thicknesses. When the platen gap adjust lever is moved forward or backward, the carriage guide shaft rotates. This rotation moves the carriage either toward or away from the platen, and changes the platen gap. Setting the adjust lever to position 2 (the 5th slot from the top) turns off the platen gap switch, which slows down the printing speed of the printer to protect the printhead. The platen gap **(PG)** sensor detects the position of the adjust lever. The correct platen gap is 0.38 mm ± 0.02 mm with the adjust lever set to position 0.

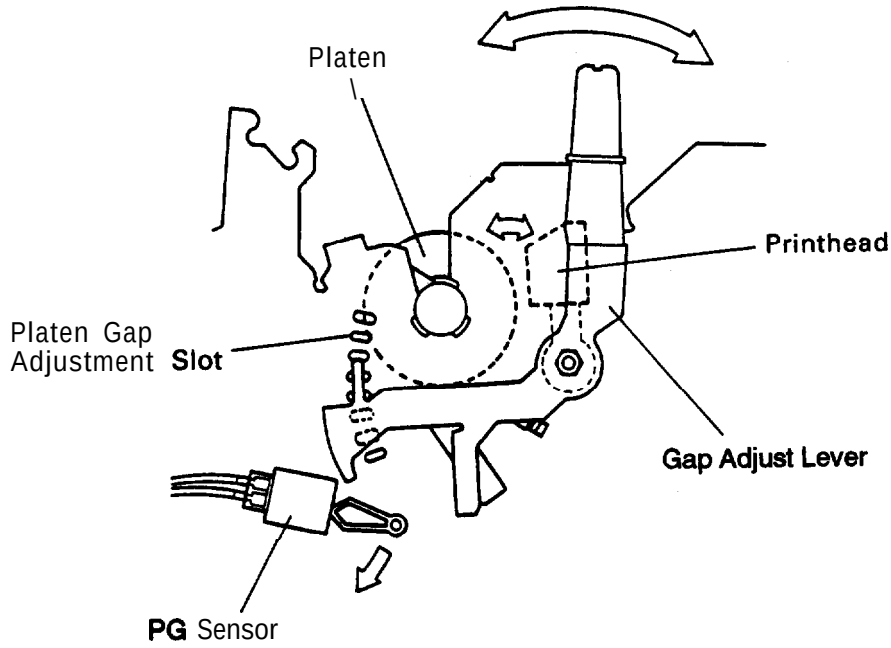


Figure 6-3. Platen Gap Adjust Lever

Paper Handling Mechanisms

During normal operation, paper is fed to the printer, advanced to the specified position, and ejected from the printer. These paper handling operations are performed by various paper handling mechanisms, such as the tractors, platens, rollers, and gears. This section describes the printer's paper handling mechanisms.

Paper Feed Mechanisms

Cut sheets are fed by friction. Continuous paper is fed by a tractor. There are three ways to feed paper with tractors: the push tractor method, the pull tractor method, and the push-pull tractor method. During normal operation, the printer is set up with only one tractor, which functions as either a push or a pull tractor, depending on where it is attached on the printer. To use the push-pull tractor feed method, an optional tractor must be attached.

There are four paper entrances for feeding paper into the printer. Different paper entrances are used for different types of paper. Table 6-1 lists which paper paths can be used with each paper feed method.

Table 6-1. Paper Feed Methods and Paper Entrances

Paper Feed Method	Paper Entrance			
	Rear	Front	Bottom	Top
Friction	No	OK	No	OK
Push tractor	OK	OK	No	No
Pull tractor	OK	OK	OK	No
Push-pull tractor	OK	OK	No	No

Paper Advance Mechanisms

This section describes how the friction advance and tractor advance mechanisms work to advance the paper through the printer.

Friction Advance Method

The paper is held between the platen and paper guide rollers and between the paper tension roller and paper tension unit cover. The paper feed (PF) motor pinion gear, turning in the direction of the black arrow, drives the paper advance reduction gear. The paper advance reduction gear turns the platen gear and the paper tension roller gear. The paper advances in the direction of the white arrow. Figure 6-4 illustrates the friction advance method when the paper is fed through the top paper entrance.

In the friction advance method, the paper guide roller spring holds the paper against the platen. **You** can release this pressure and free the paper by setting the release lever to the tractor feed position.

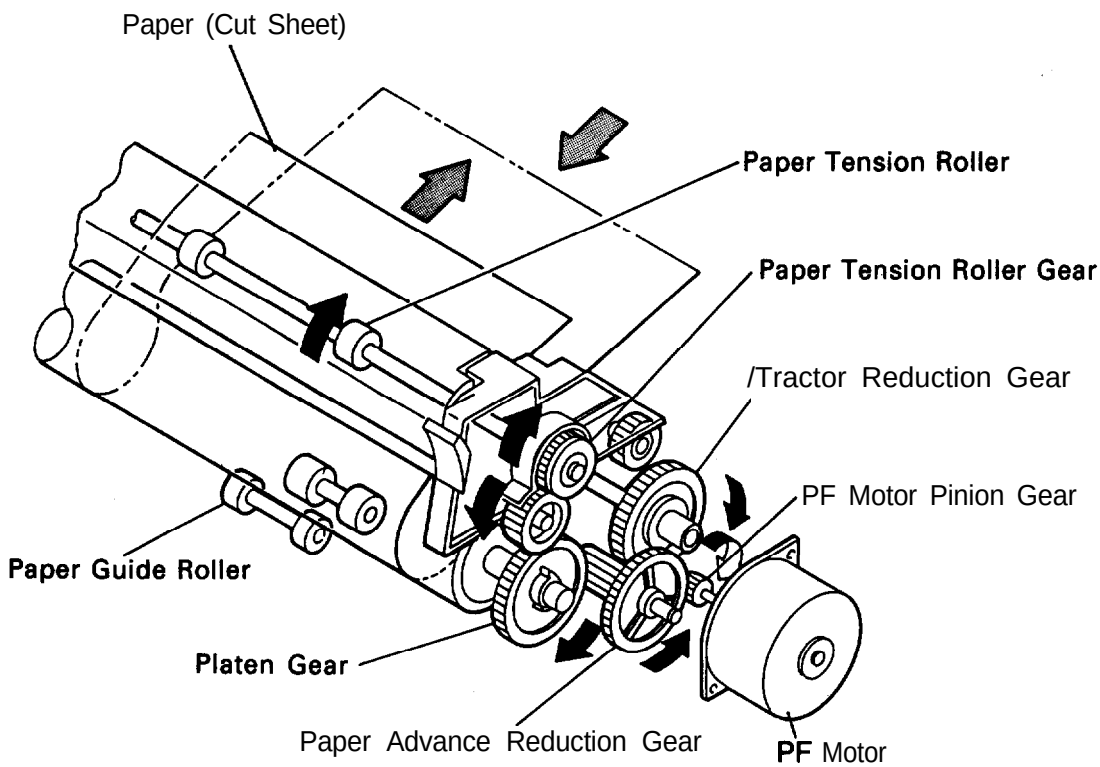


Figure 6-4. Friction Advance Operation Using the Top Paper Entrance

Push Tractor Method

When the push tractor method is used with the rear entrance, the torque generated by the PF motor is transmitted to the push tractor gear through the PF motor pinion gear, paper advance reduction gear, and tractor reduction gear. When the PF motor pinion gear turns in the direction of the black arrow, the tractor gear rotates in the direction of the black arrow and thus feeds the paper into the printer. The paper is advanced by the platen and the paper tension roller, which are also driven by the PF motor through the gear train.

When the push tractor method is used with the front entrance, the torque generated by the PF motor is transmitted to the push tractor gear through the PF motor pinion gear, paper advance reduction gear, platen gear, and the gear train in the front part of the printer. When the PF motor pinion gear turns in the direction of the black arrow, the tractor gear rotates in the direction of the black arrow and thus feeds the paper into the printer. The paper is advanced by the paper drive roller and the platen, which are also driven by the PF motor through the gear train.

In the push tractor method, the release lever is set to one of the tractor positions to release the pressure between the paper advance roller and the platen. Figure 6-5 illustrates push tractor operation when paper is fed through the rear paper entrance. Figure 6-6 illustrates push tractor operation when paper is fed through the front paper entrance.

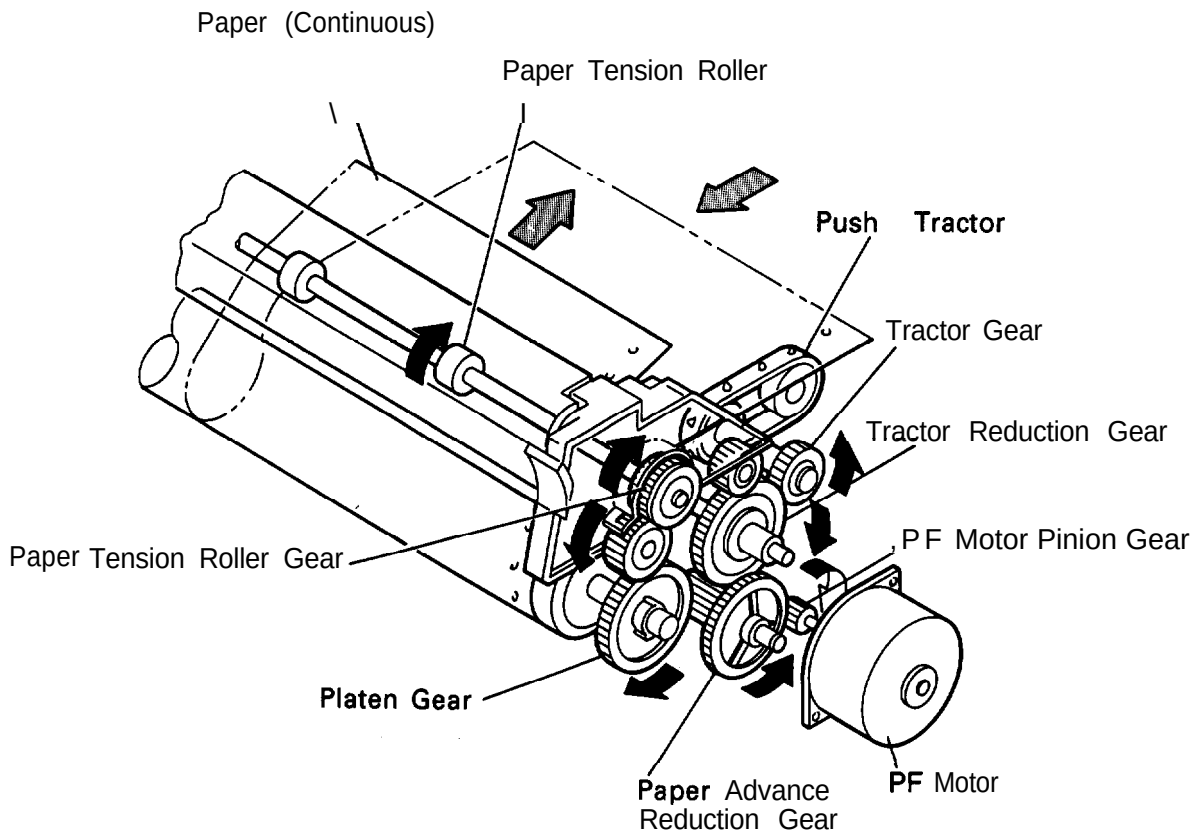


Figure 6-5. Push Tractor Operation Using the Rear Paper Entrance

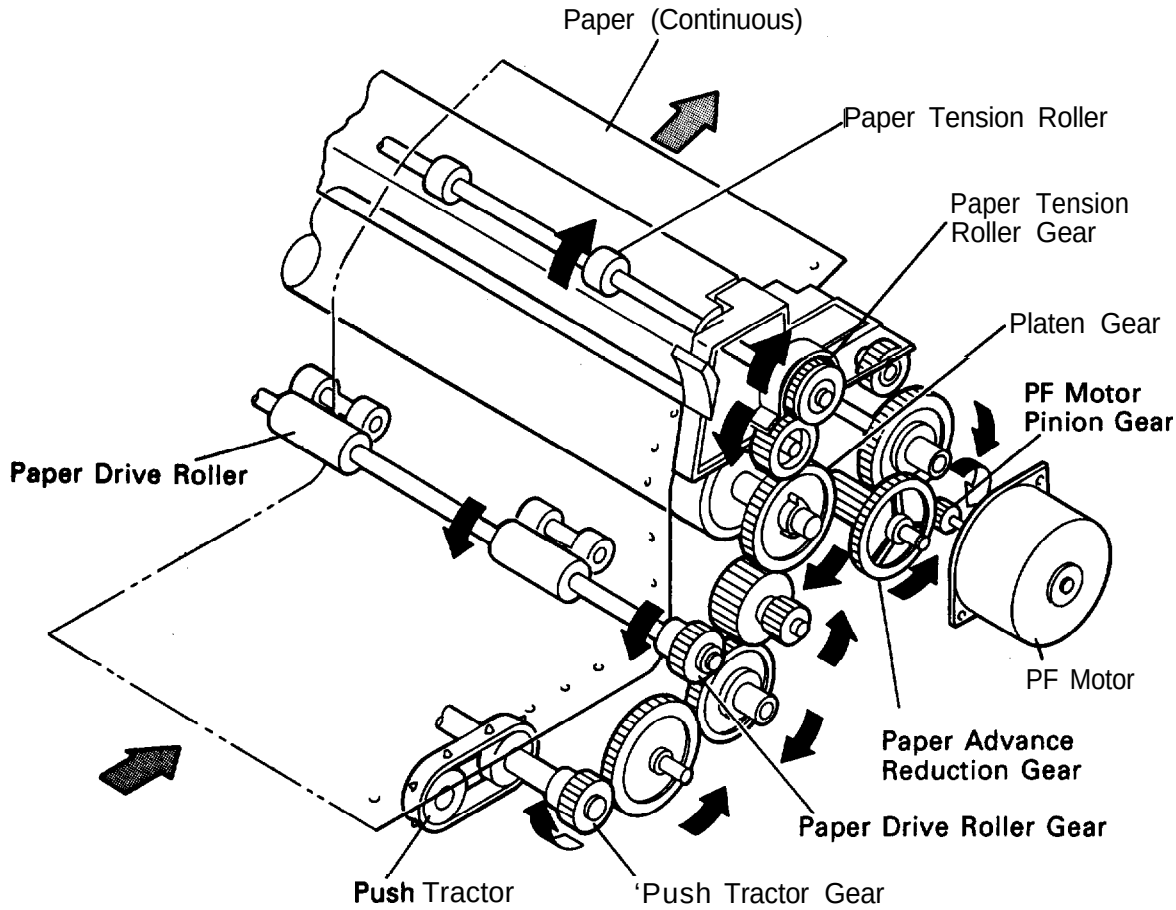


Figure 6-6. Push Tractor Operation Using the Front Paper Entrance

Pull Tractor Method

The pull tractor advances paper in basically the same way as the push tractor. The push tractor is installed at the paper entrance and pushes the paper into the printer mechanism. The pull tractor, however, is installed at the paper exit and pulls the paper out of the printer mechanism. As the result, the paper tension unit is not required.

Figure 6-7 illustrates pull tractor operation when the paper is fed through the bottom paper entrance.

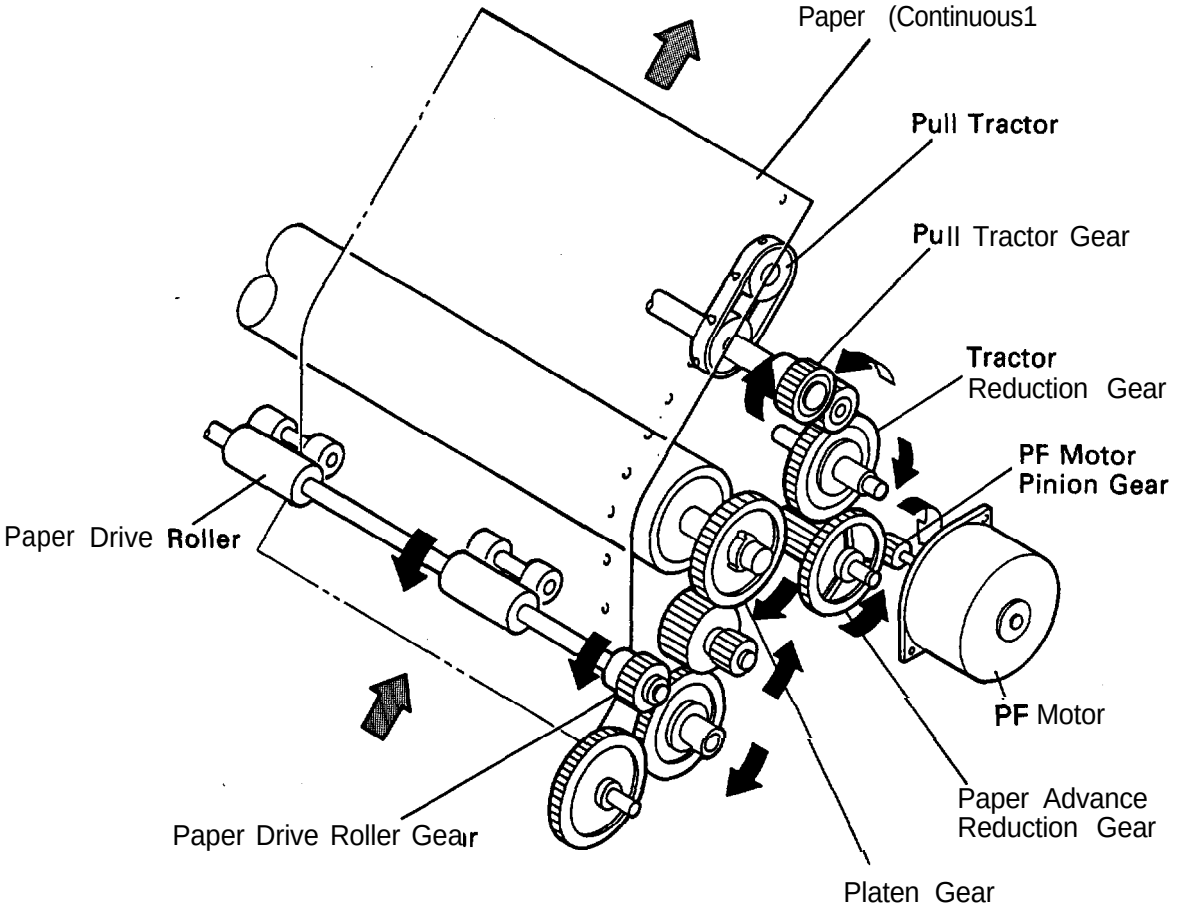


Figure 6-7. Pull Tractor Operation Using the Bottom Paper Entrance

Push-pull Tractor Method

The push-pull tractor method is a combination of the push and pull tractor methods. Two tractors are used to advance the paper: one at the front paper entrance and the other at the rear paper entrance. They operate simultaneously to push and pull the paper through the printer mechanism. Figure 6-8 illustrates push-pull tractor operation when the paper is fed through the rear paper entrance. Figure 6-9 illustrates push-pull tractor operation when the paper is fed through the front entrance.

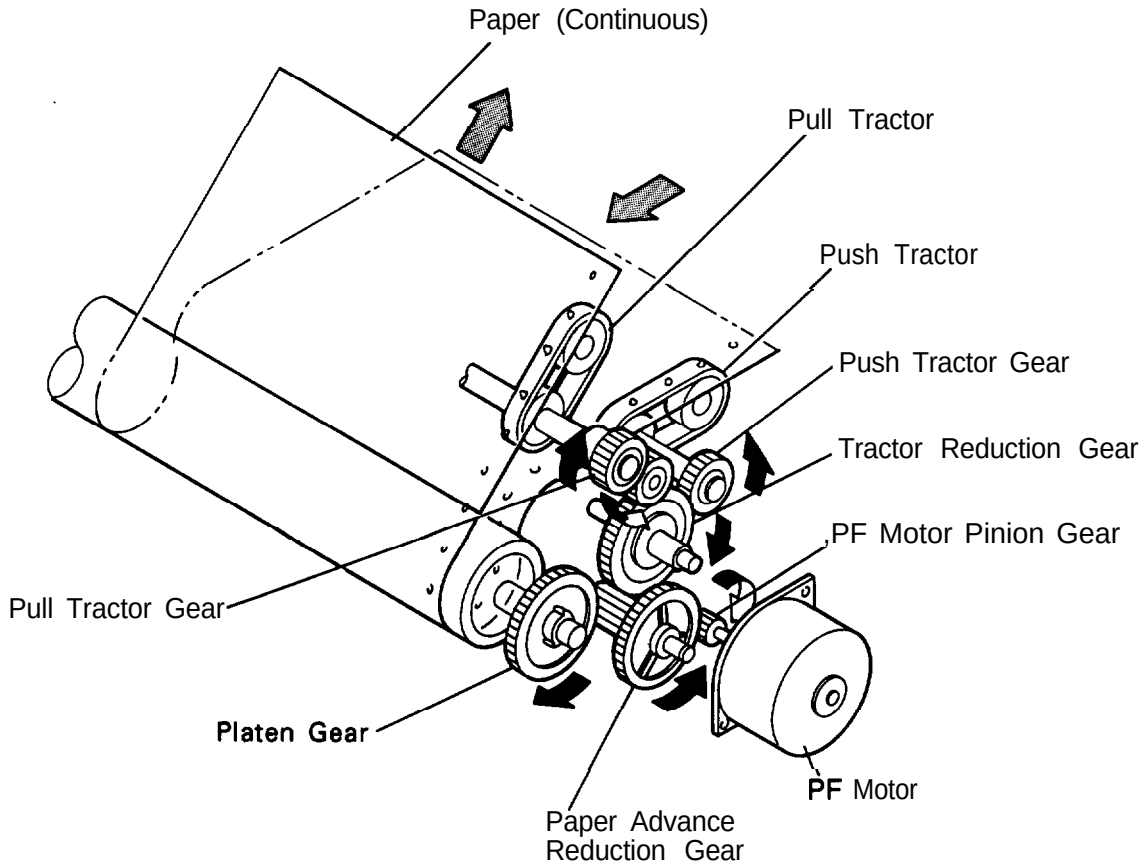


Figure 6-8. Push-pull Tractor Operation Using the Rear Paper Entrance

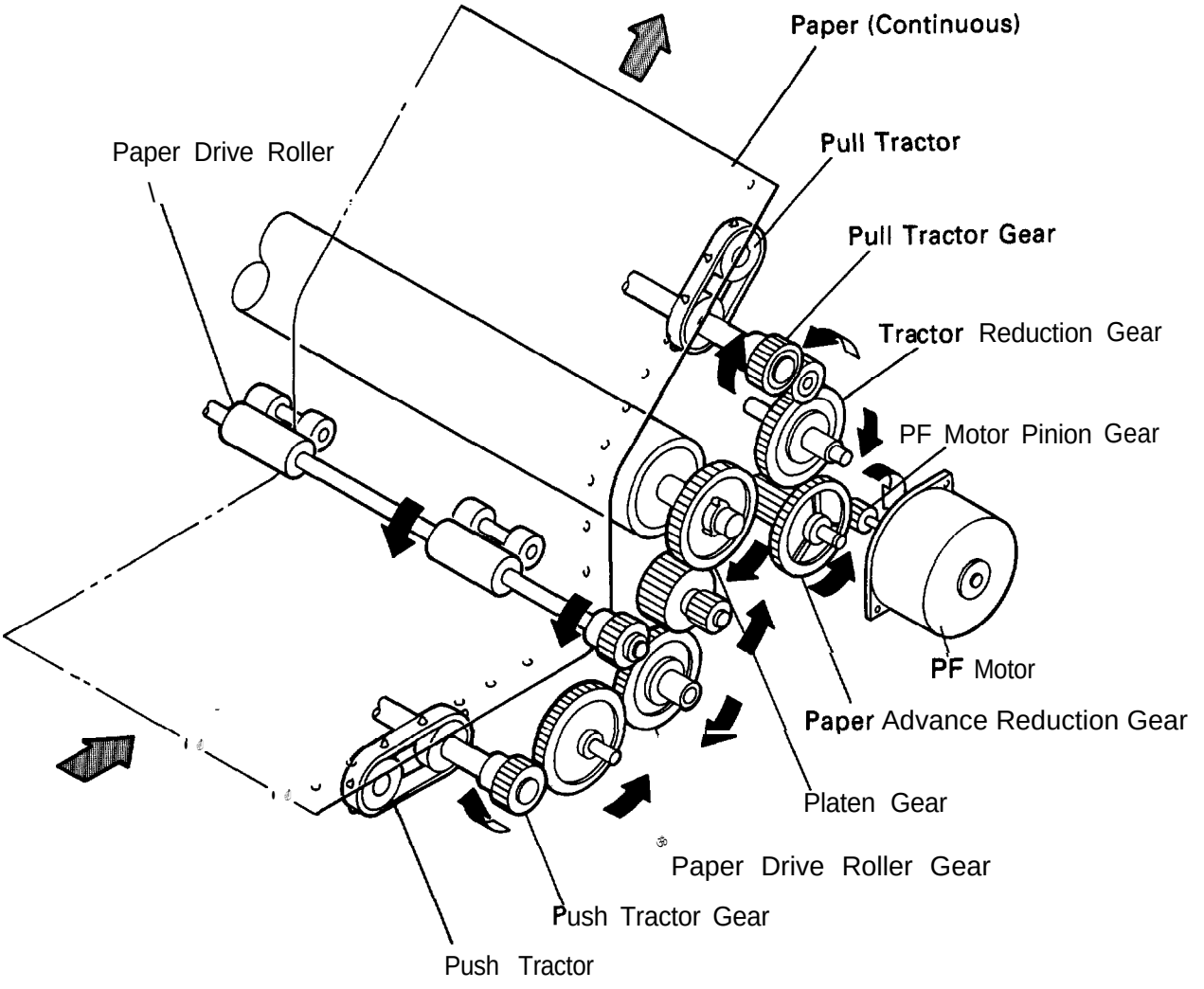


Figure 6-9. Push-pull Tractor Operation Using the Front Paper Entrance

The Release Lever

The release lever is used to select friction or tractor feeding or to release the paper. When the release lever is set to the friction feed position, the paper guide rollers are pressed against the platen. When it is set to one of the tractor feed positions, this pressure is released and the paper guide rollers are separated from the platen. When it is set to the paper free position, the paper drive roller and the lower paper guide roller at the front entrance are separated from each other. Figure 6-10 illustrates the release lever; Figure 6-11 shows the function of each release lever setting.

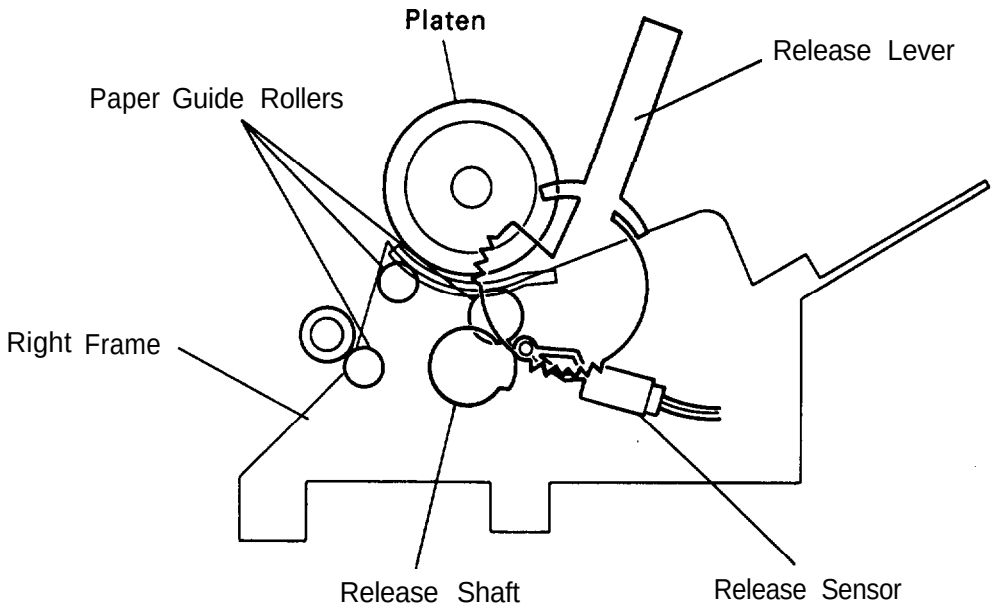


Figure 6-10. Release Lever

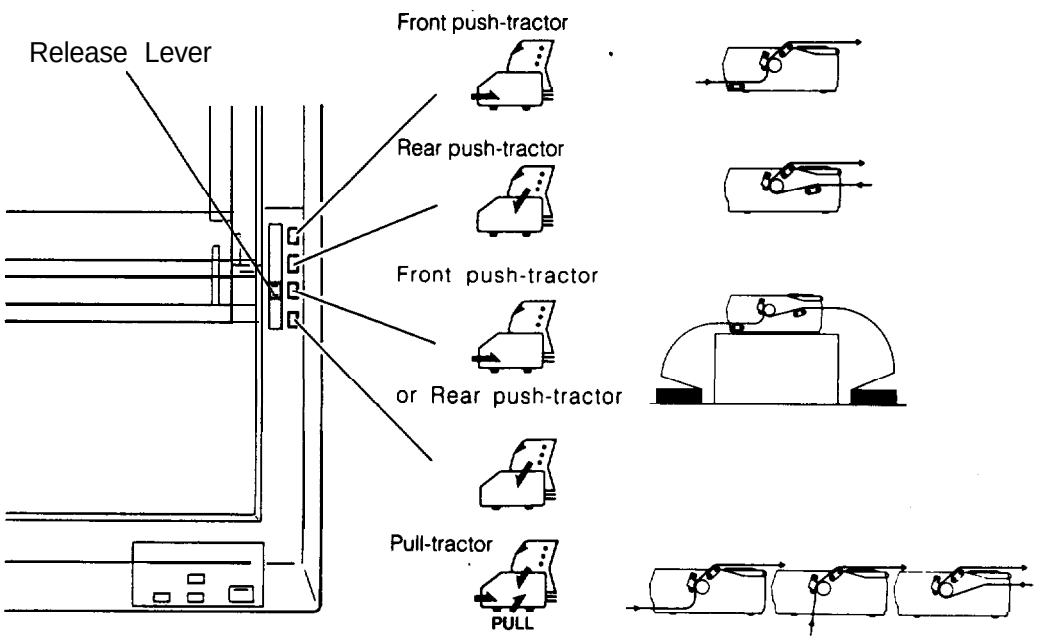


Figure 6-11. Release Lever Setting Functions

Paper Paths

This section describes the various paths the paper follows through the printer mechanism. These paper paths are divided into four groups, depending on the entrance the paper is fed from (top, rear, bottom, or front).

Note: The front paper-end (PE) sensor is located in front of the printer mechanism and the rear PE sensor is located behind the printer mechanism.

Top Entrance

Figure 6-12 shows the paper path for friction feeding using the top entrance. The top entrance is used only for the friction feed method. When the top entrance is used, the rear PE sensor senses when paper is out.

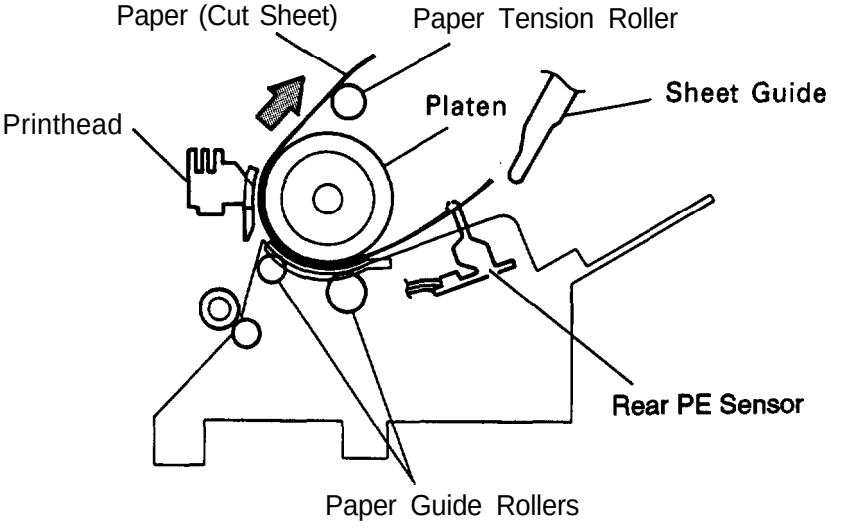


Figure 6-12. Paper Path for Friction Feeding Using the Top Entrance

Rear Entrance

Figures 6-13 and 6-14 show the paper paths for tractor feeding using the rear entrance. The rear entrance can be used **for** any of the following paper feed methods: push tractor feed, pull tractor feed, or the push-pull tractor feed. When the rear entrance is used, the rear PE **sensor** senses when paper is out.

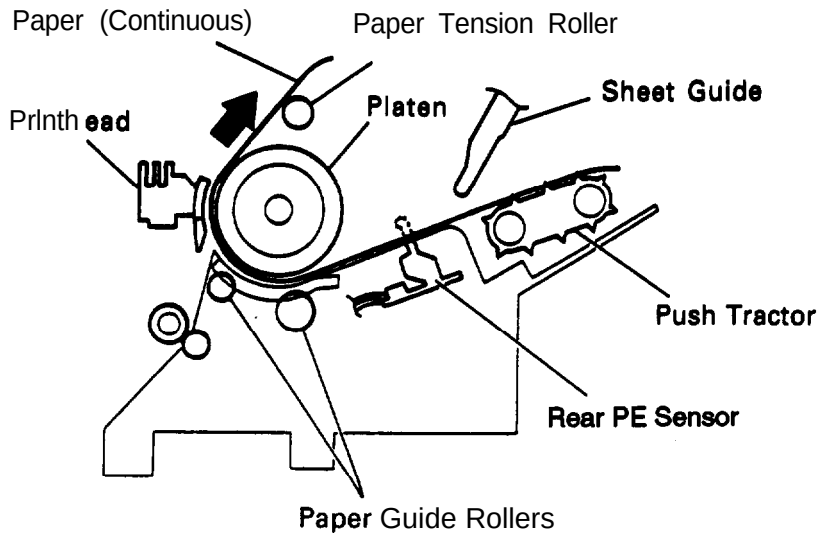


Figure 6-13. Paper Path for Push Tractor Feeding Using the Rear Entrance

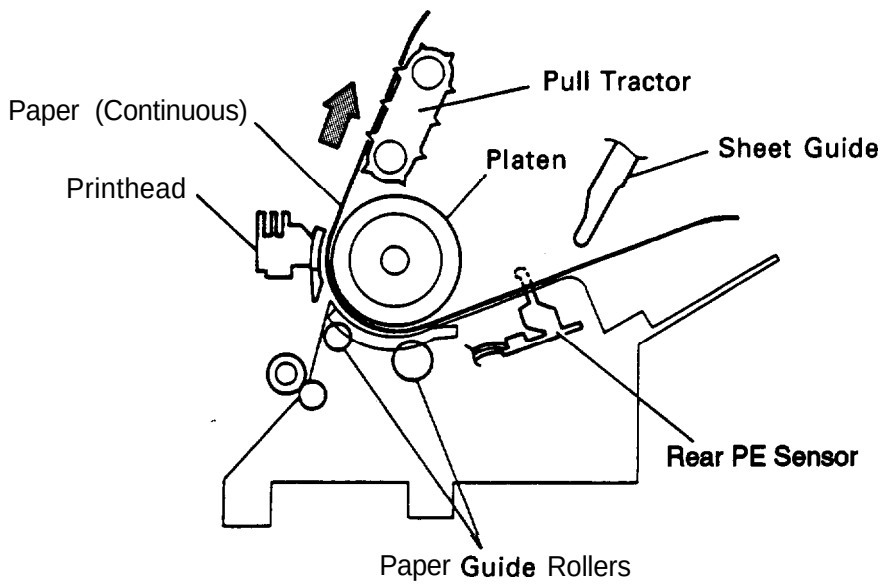


Figure 6-14. Paper Path for Pull Tractor Feeding Using the Rear Entrance

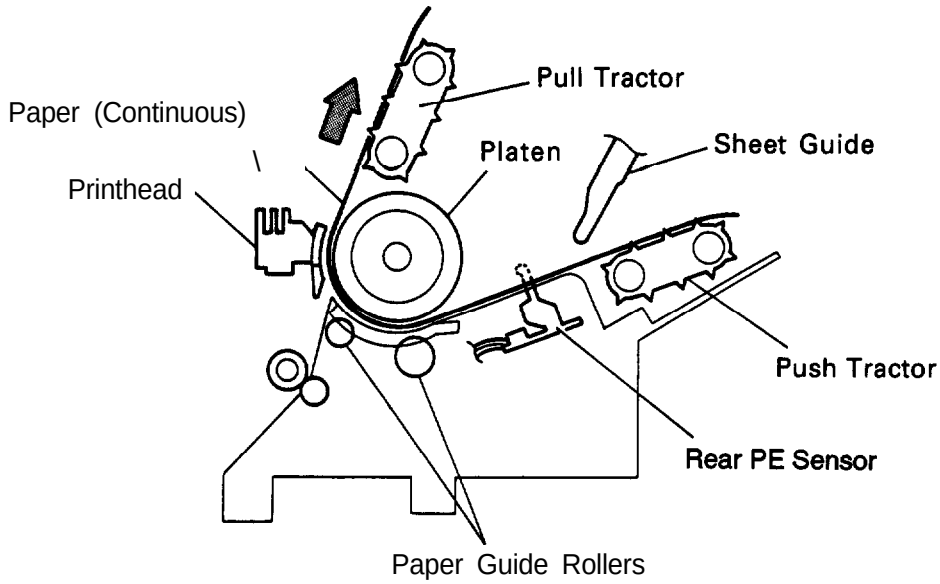


Figure 6-15. Paper Path for Push-pull Tractor Feeding Using the Rear Entrance

Bottom Entrance

Figure 6-16 shows the paper path for tractor feeding using the bottom entrance. The bottom entrance is used only for pull tractor feeding. When the bottom entrance is used, the front PE sensor senses when paper is out.

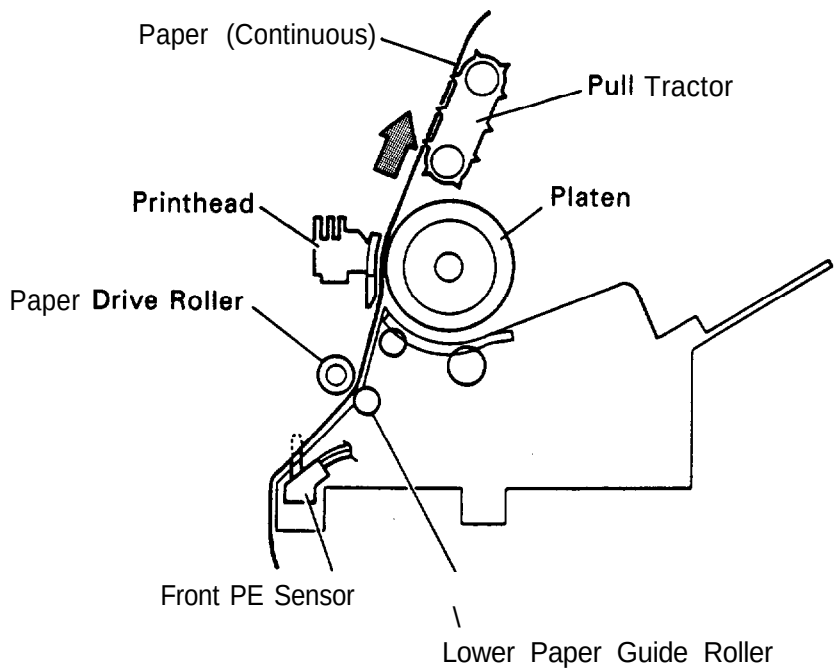


Figure 6-16. Paper Path for Pull Tractor Feeding Using the Bottom Entrance

Front Entrance

Figures 6-17 through 6-20 show the paper paths for the front entrance. The front entrance can be used with any of the following paper feed methods: friction feed, push tractor feed, pull tractor feed, or push-pull tractor feed. When the front entrance is used, the front PE sensor senses when paper is out.

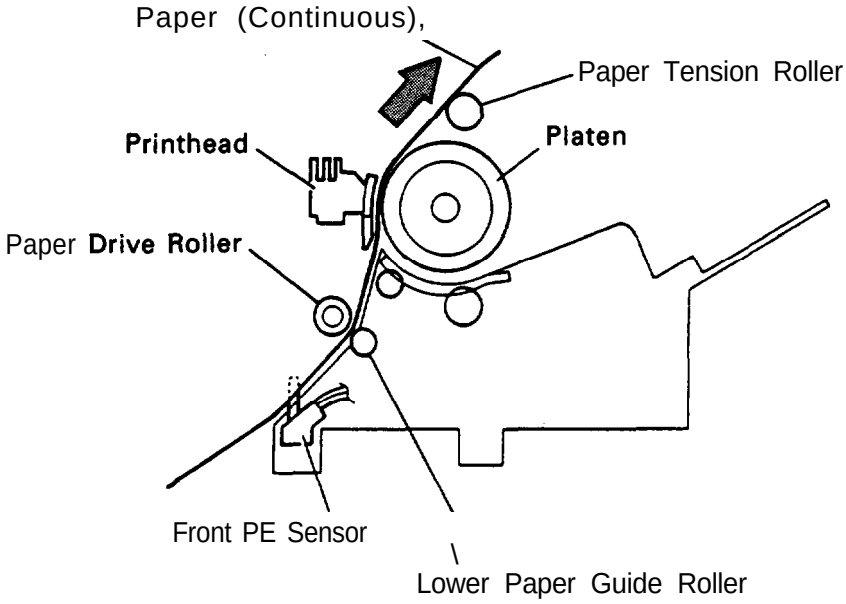


Figure 6-17. Paper Path for Friction Feeding Using the Front Entrance

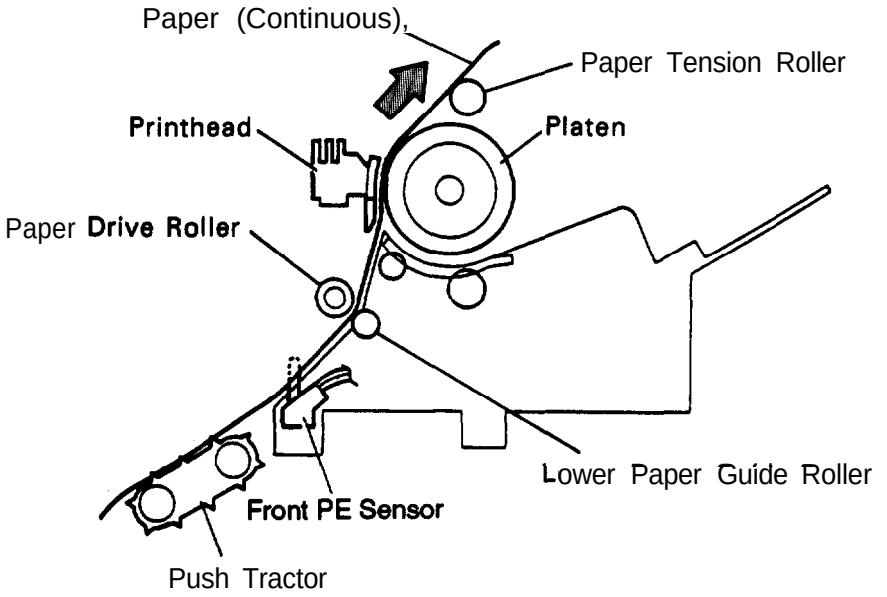


Figure 6-18. Paper Path for Push Tractor Feeding Using the Front Entrance

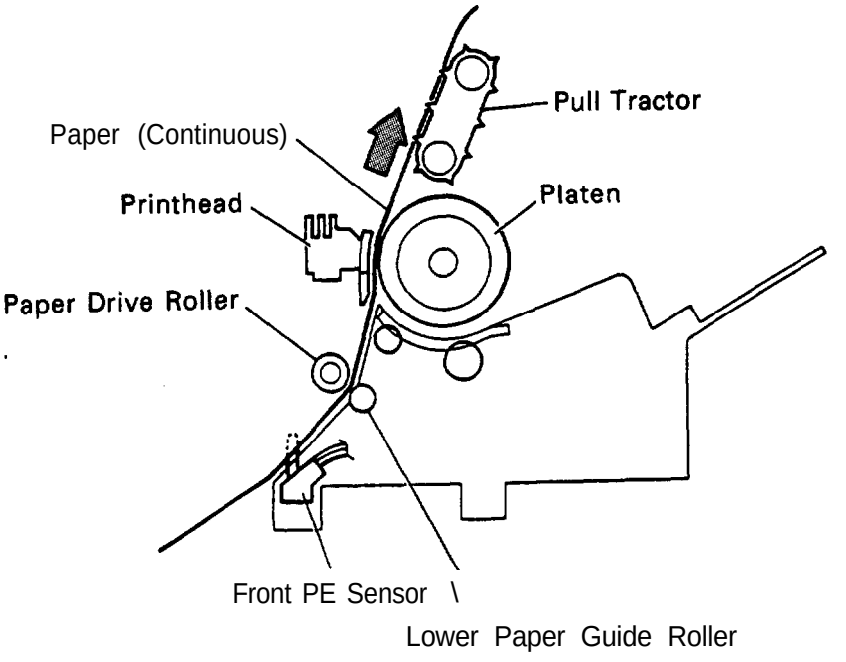


Figure 6-19. Paper Path for Pull Tractor Feeding Using the Front Entrance

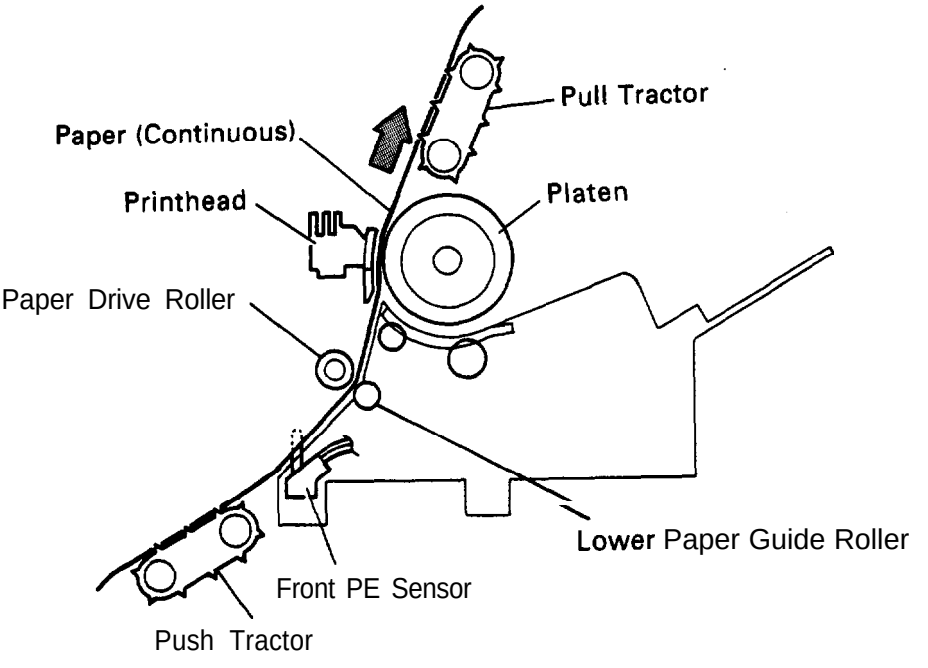


Figure 6-20. Paper Path for Push-pull Tractor Feeding Using the Front Entrance

Ribbon Advance Mechanism

The ribbon is held between the ribbon advance roller (ribbon driving gear) and the ribbon pressure roller. When the carriage moves on the shaft, the timing belt turns the belt driven pulley, and the torque is transmitted to the ribbon driving gear through the gear train. The ribbon driving gear rotates counterclockwise no matter what direction the carriage moves, because the planetary gear is used in the gear linkage.

Table 6-2. Ribbon Advance Gear Linkage

Direction of Carriage Movement	Gear Linkage
Left to right (indicated by the black arrow)	Belt-driven pulley 3 Gear 1 ➔ Gear 2 3 Ribbon-driving gear
Right to left (indicated by the white arrow)	Belt-driven pulley ⇨ Gear 1 ⇨ Gear 3 ⇨ Gear 4 ⇨ Ribbon-driving gear

The ribbon brake spring, attached to the exit slot of the cartridge case, prevents slack in the ribbon and keeps the ribbon tension at an appropriate level. The ribbon mask prevents the ribbon from brushing against the paper.

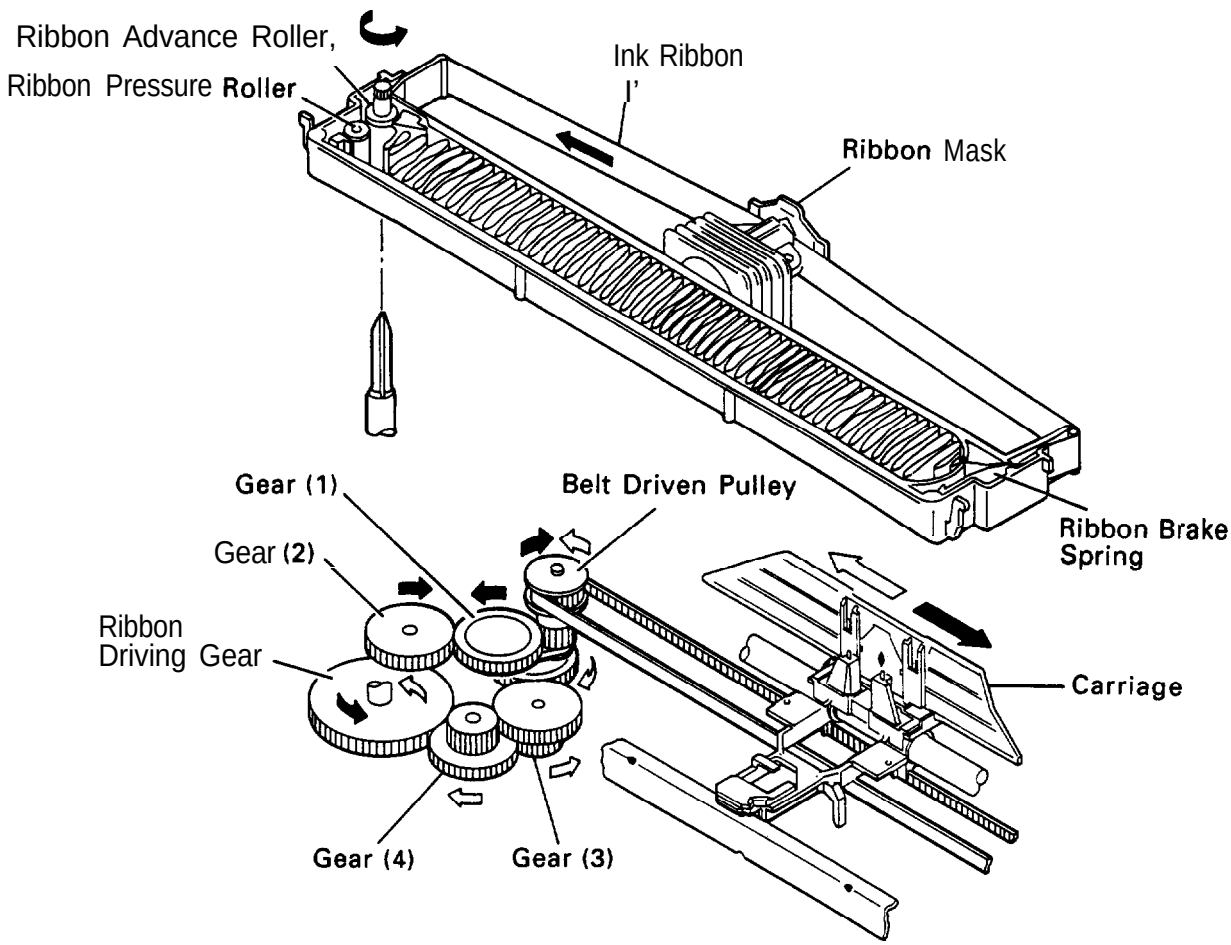


Figure 6-21. Ribbon Advance Mechanism

Power Supply Operation

The FX-870/1170 printer is powered by a 120 VAC power supply board (C076 PSB board assembly). This board outputs the DC current necessary to drive the printer control circuits and the printer drive mechanism. Fuse **F1 (2.5 A/125** V) is used to protect the power supply circuit of the board in case of a short circuit.

Table 6-3. Power Supply Input Voltage and Fuse Rating

Input Voltage	Fuse F1 Rating
103.5 - 132 VAC	2.5 A/125 V

Power Supply Overview

The power supply board has two power output lines that supply power to the control circuits and the drive mechanisms. Table 6-4 lists the components (parts or assemblies) of the printer that are powered by these two DC voltages.

Table 6-4. Power Supply Output Voltages and Applications

Output Voltage (DC)	Applications
+35 v	CR (carriage) motor drive PF (paper feed) motor drive Printhead drive
+5 v	Main control board logic circuitry Sensors Control panel LEDs PF (paper feed) motor hold

Power Supply Circuit Operation

Figure 6-22 shows the power supply circuitry in block diagram form. When AC power enters the printer from an external power source, the filter circuit removes the noise. The AC voltage then undergoes full wave rectification and is smoothed to produce direct current. The voltage is then fed through the switching circuit and the secondary smoothing circuit to produce a stepped down +35 VDC voltage. A +35 VDC detector circuit is connected to the switching circuit. This feedback control arrangement ensures a stable +35 VDC voltage supply.

A +5 VDC voltage is generated by feeding the +35 VDC voltage through the +5 VDC power supply circuit, where the +35 VDC is stepped down to a stable +5 VDC voltage. The switching regulator IC containing the overcurrent/overvoltage control circuits performs this function. It controls the +5 VDC line output.

The +5 VDC voltage-overload protection circuit cuts the +5 VDC line output if the voltage exceeds +7 VDC. It stops the operation of the switching circuit and then the output of +35 VDC voltage.

The +35 VDC line has a voltage-overload protection circuit and a voltage drop protection circuit. The +35 VDC voltage-overload protection circuit cuts the +35 VDC line output if the voltage exceeds +36 VDC. It stops the operation of the switching circuit and then the output of the +35 VDC voltage. The voltage drop protection circuit protects the printer against a sudden voltage drop that may be caused by a short circuit in the secondary circuitry of the +35 VDC line. If a voltage drop is detected, it stops the operation of the switching circuit and then the output of the +35 VDC voltage.

An external switch is used to turn printer power on or off. When the power switch is turned off, the switching circuit is de-energized and the output of the +35 VDC voltage is stopped. However, since the switch is in the secondary circuitry, current continues to flow in the primary circuitry as long as the printer remains plugged into an external AC power source. For this reason, you must disconnect the printer from the external AC power source. Unplug the power cable from the AC power outlet before you perform any maintenance work.

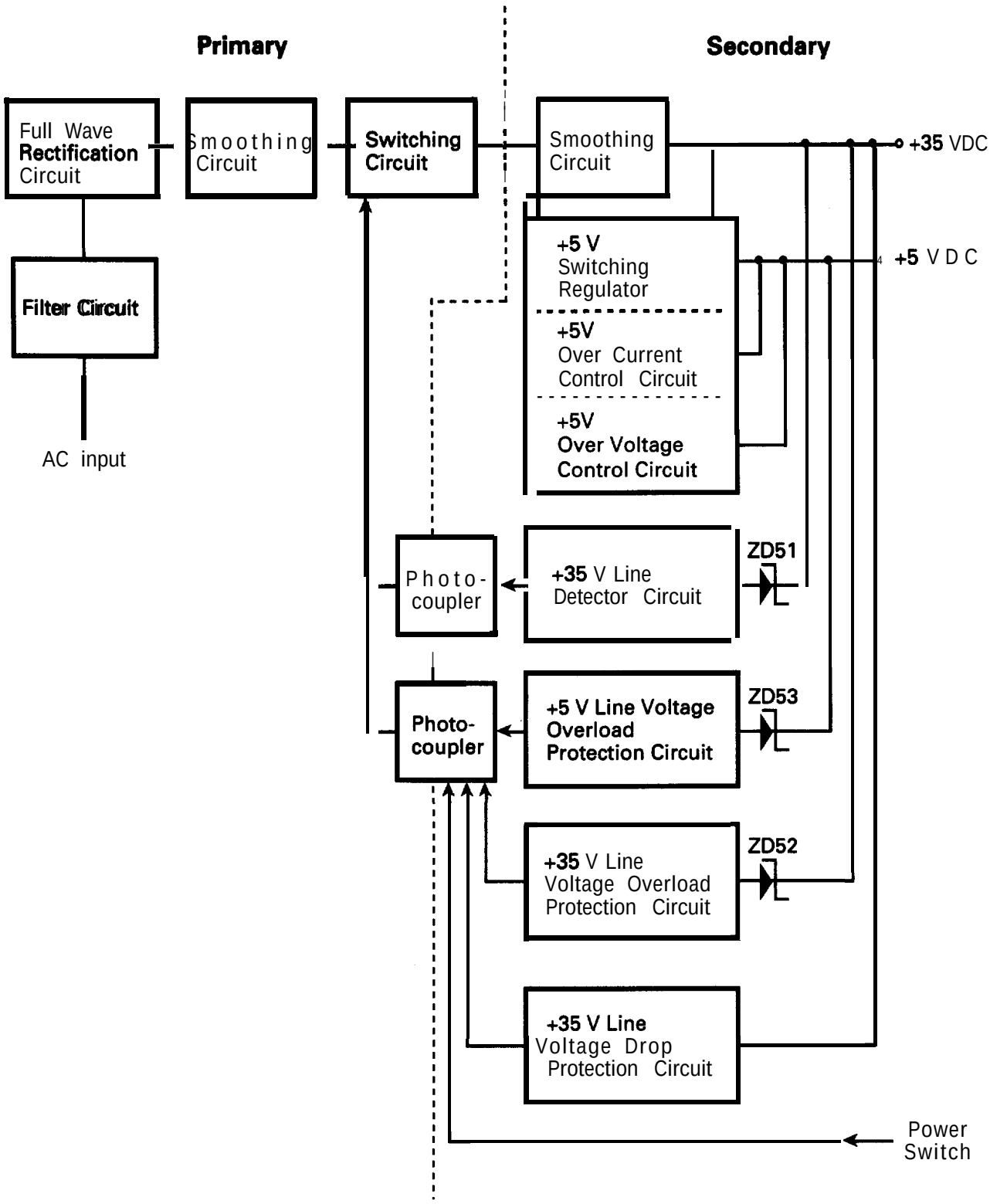


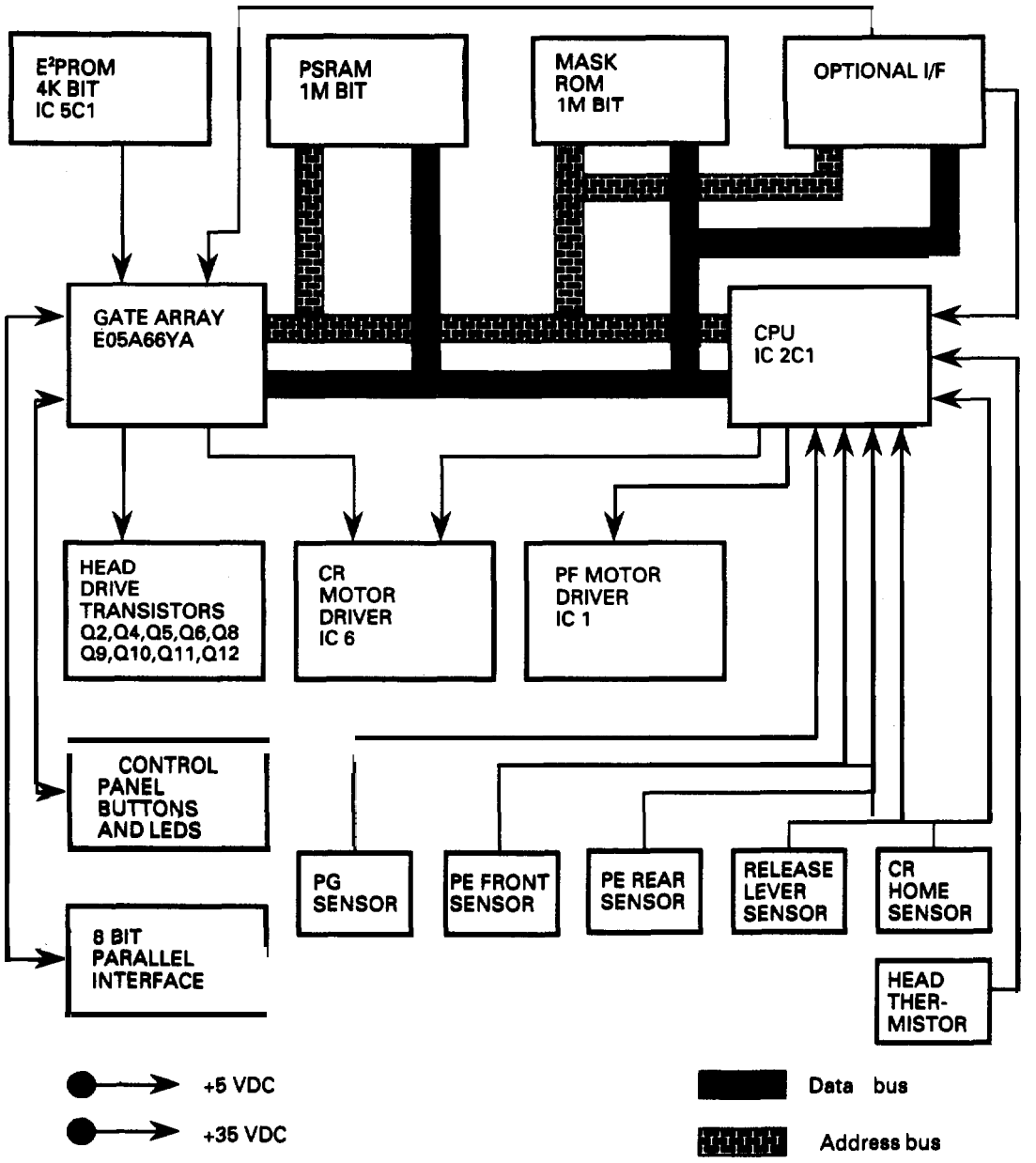
Figure 6-22. Power Supply Circuit Block Diagram

Control Circuit Operation

The control circuit consists of two circuit boards: the CO94 MAIN (main control circuit board) and the CO94 PNL (control panel circuit board). This section describes the operation of these boards.

Control Circuit Operation Overview

The CPU on the CO94 MAIN is an **8-bit TMP90C041F** microprocessor (9.83 MHz). It oversees control of all the components of the printer. The **E05A66YA** gate array contains various memory management functions that control the memory assignment and **I/O** areas. The output signals **from** each detector are sent to the analog input port of the CPU. The signals from the control panel are sent to the gate array, which in turn, sends LED signals to the control panel. The two motors (CR and PF) are controlled by signals sent from the stepping motor control port of the CPU. Figure 6-23 shows the control circuits in block diagram form.



Figure! 6-23. Control Circuit Block Diagram

Figure 6-24 shows the data flow from the host computer to the printhead. Data sent from the host computer is converted to image data and transmitted to the printhead through the gate array.

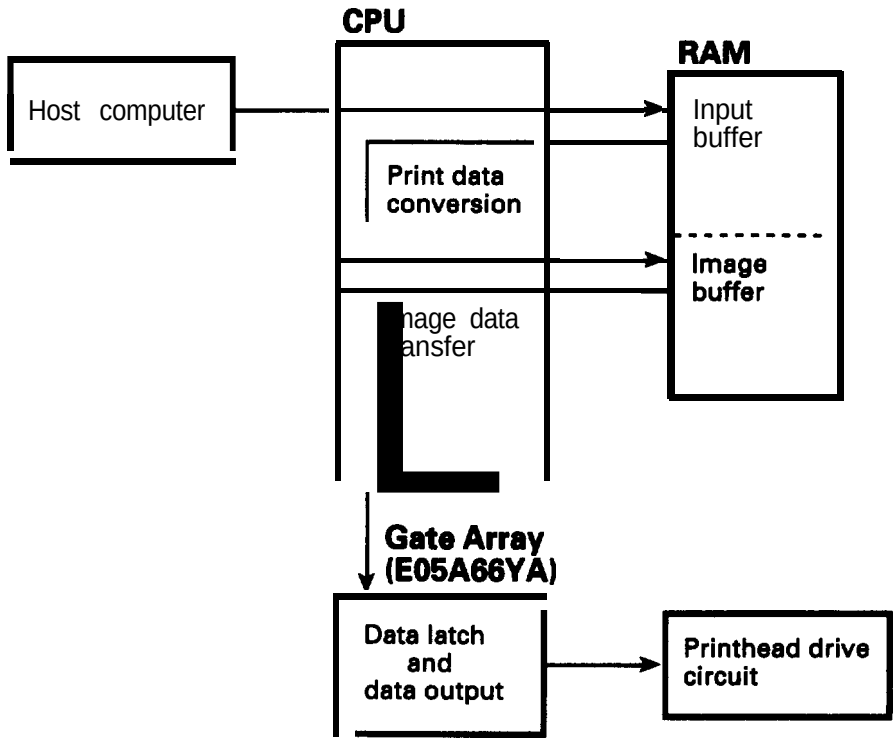


Figure 6-24. Data Flow

Table 6-5 lists the **functions** of the main **components** of the CO94 MAIN.

Table 6-5. Functions of Main Components of C094 MAIN

IC or Circuit	Functions
TMP90C041F (2C1)	Receives data from the host computer and **loads** it to the input buffer in RAM. Expands the input data held in the buffer to create image data. Loads the image data to the image buffer in RAM. Transfers the image **data to** the printhead drive circuit. Also controls various printer mechanism parts, such as the motors.
E05A66YA (IC4)	This gate array mainly performs the following five functions: • Memory management • Centronics **I/F** control • Control panel control • **E²PROM** control • Printhead drive circuit control
PROM (iC3)	The PROM contains the program that runs the CPU.
RAM (iC2)	The RAM contains the CPU working area and the buffers.
E²PROM (5CI)	The **E²PROM** is used to store information such as the top-of-form position.
UPA1475H (IC1)	Drive circuit for PF motor
SLA7024M (iC5)	Drive circuit for CR motor

Reset Circuit

The control circuits are initialized when the $\overline{\text{RESET}}$ signal is issued. The reset operation occurs under these two conditions:

1. Power on reset

   Immediately after the power is turned on, +35 VDC is rapidly generated. Because it takes a moment for the voltage at ZD2 to reach +31.5 V, the voltage at the DISC terminal on the gate array does not reach +5 VDC until capacitor C24 is fully charged. A similar integration circuit is provided in the gate array and further delays the output of the $\overline{\text{ROUT}}$ signal. This LOW level is used as a reset signal.

2. INIT signal reset

   The reset signal is also issued when the INIT signal is sent from the host computer.

Figure 6-25 shows the power on reset circuit.

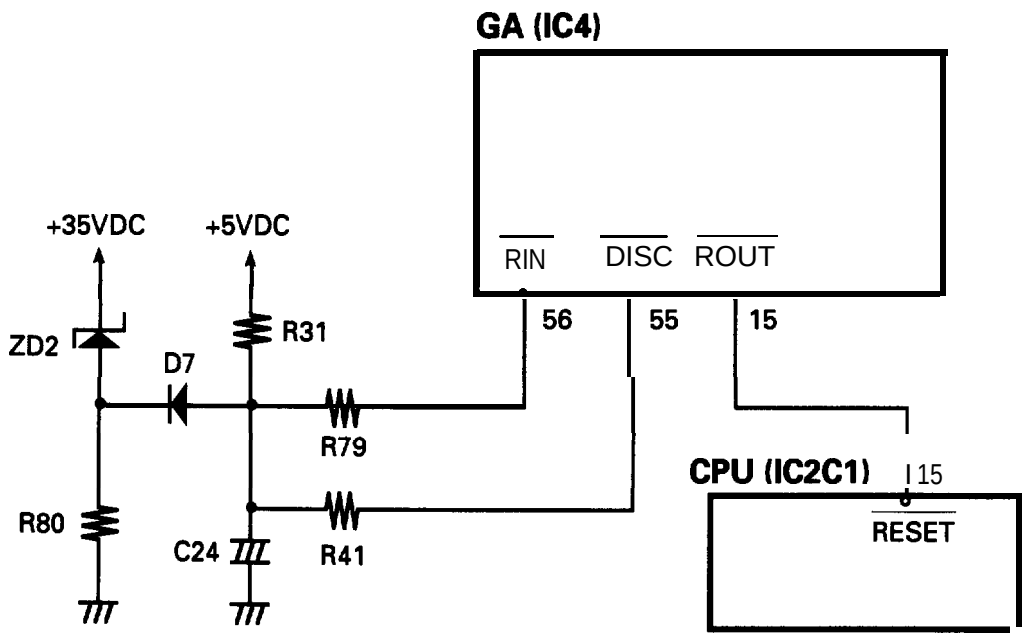


Figure 6-25. Power On Reset Circuit

Sensor Circuits

The FX-870/1170 printer has the following sensors: CRHOME, PE (FRONT), PE (REAR), PG (platen gap), RELEASE LEVER(RL), and HEAD TEMPERATURE. All the sensors are mechanical switches, except the rear PE sensor, which is a photo diode, and the HEAD TEMPERATURE sensor, which is a thermistor.

In addition to the sensor circuits, a +35 V monitor circuit and a Vref circuit are also provided. The +35 V monitor circuit sets the pulse length of the head drive signal. If the voltage of the +35 V line drops below approximately +31 V, the printer stops printing for a while. As soon as the voltage recovers, the printer starts to print at halfspeed. (The PF motor also slows down.) The Vref circuit supplies the reference voltage for the A/D convertor in the CPU.

The CPU constantly monitors the printhead temperature. If the printhead temperature exceeds the maximum level, the printer stops printing until the temperature drops to a certain level. When the printhead temperature cools down, the printer resumes printing automatically.

Figure 6-26 shows the sensor circuit block diagram.

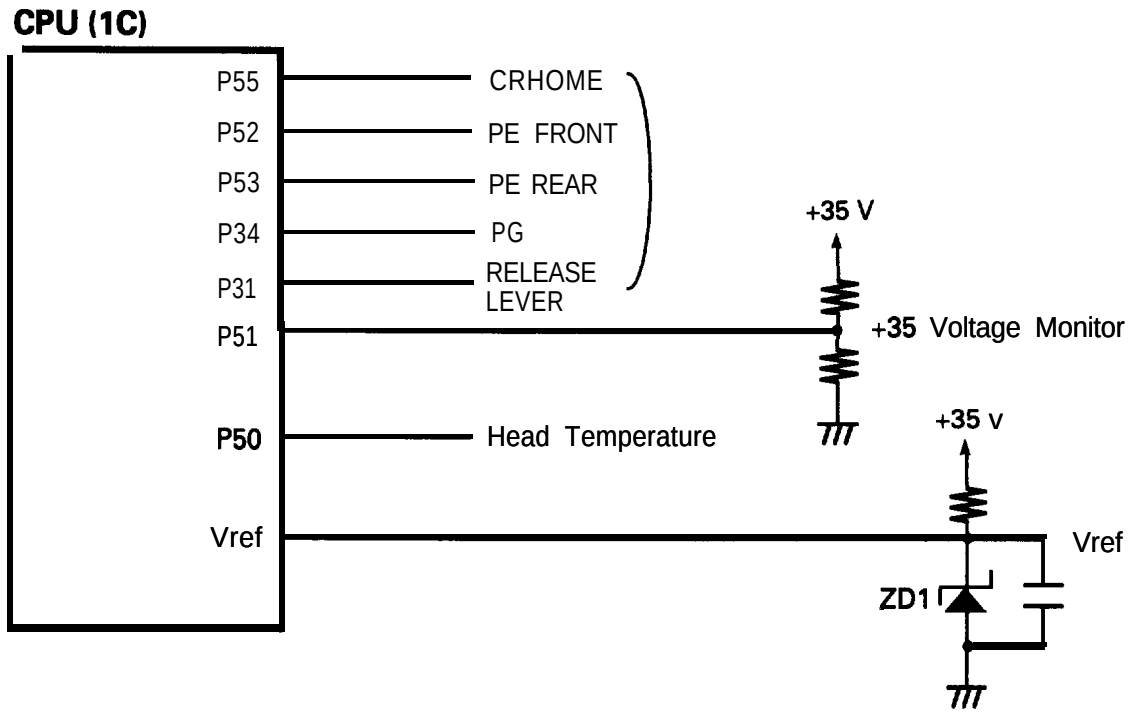


Figure 6-26. Sensor Circuit Block Diagram

Carriage Motor Drive Circuit

The carriage motor drive circuit controls the CR motor. An open loop, constant-current drive arrangement runs the **CR motor.** 2-2 and 1-2 phases are used to excite the motor. A 2-2 phase step is equivalent to a 1-2 phase step doubled. Table 6-6 describes the motor drive modes.

The CR motor drive circuit of the **SLA7024M** (IC6) detects and regulates the amount of current flowing in the carriage motor coil. The current flowing through the coil varies, depending on the speed of the CR motor. The CPU sets the amount of current via the I/O port of the gate array. Signals are sent to the ports (L, M, HOLD) on the **SLA7024M.** The **SLA7024M** sets the coil current depending on the CR motor speed.

The printer may stop printing to protect the CR motor from overheating if a continuous printing of short columns (less than 10 columns) is repeated. The printer uses CPU ports **P60** to P63 exclusively to control the CR motor.

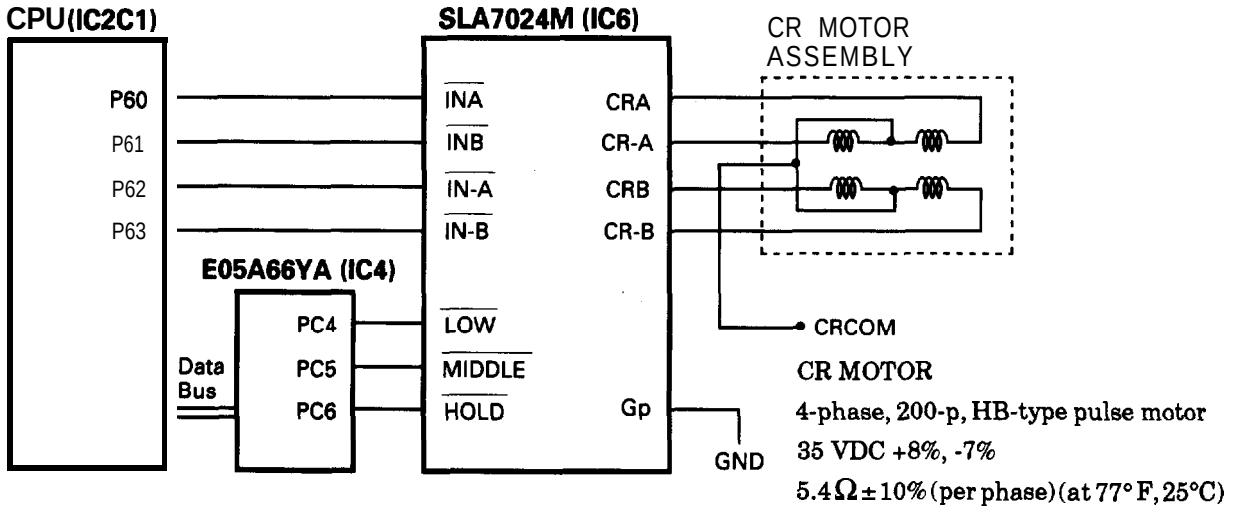


Figure 6-27. Carriage Motor Drive Circuit

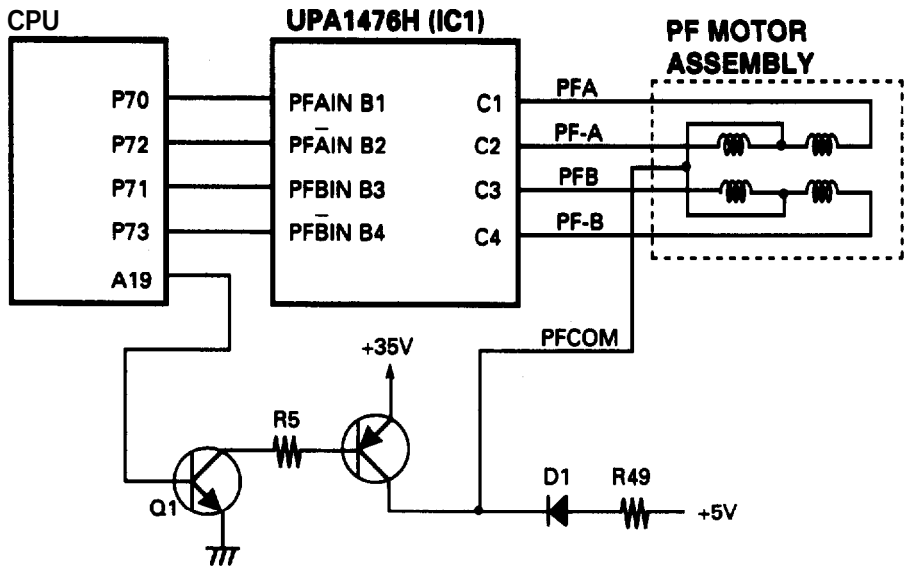
Table 6-6. Carriage Motor Drive Modes

Speed Mode	PPS	Excitation Phase	Characters Printed
4/3	4468	2-2	Super draft
9/8	3840	2-2	Super draft copy
1	3357	2-2	Draft 10 cpi
5/6	2800	2-2	
2/3	2240	2-2	4/3 high duty
1/2	1680	1-2	NLQ
5/12	1400	I-2	
1/4	840	I-2	
5/24	700	I-2	5/12 high duty
1/8	420	1-2	1/4 high duty

Paper Feed Motor Drive Circuit

The PF motor, a stepping motor, advances the paper at a minimum advance rate of 1/216 inch. This motor is a 2-2 phase, constant-voltage, drive motor. CPU ports (P70 to P73) are used to control the PF motor. Phase data for the PF motor is output through these ports. PFA to PFB are turned on or off within the µPA1476H (IC1), depending on the phase data sent from the CPU.

When there is an output at A19 of the CPU, a +35 V voltage is supplied to the PFCOM terminal of the PF motor. Otherwise, a +5 V voltage is supplied through D1 to hold the motor.



PF MOTOR
4-phase, 48-p PM-type pulse motor
35 VDC ± 10%
61 Ω ± 3 Ω (per phase) (at 77° F, 25° C)

Figure 6-28. Paper Feed Motor Drive Circuit

Printhead Drive Circuit

The printhead drive circuit receives two types of signals: image data and the pulse length control signals. Image data is created in the CPU, transferred to the gate array, and latched to the printhead. The pulse length control signal is set by the CPU. The pulse length is adjusted referring to the voltage of the +35 V line. These two types of signals are sent to the printhead to print each dot. Figure 6-29 shows the printhead drive circuit.

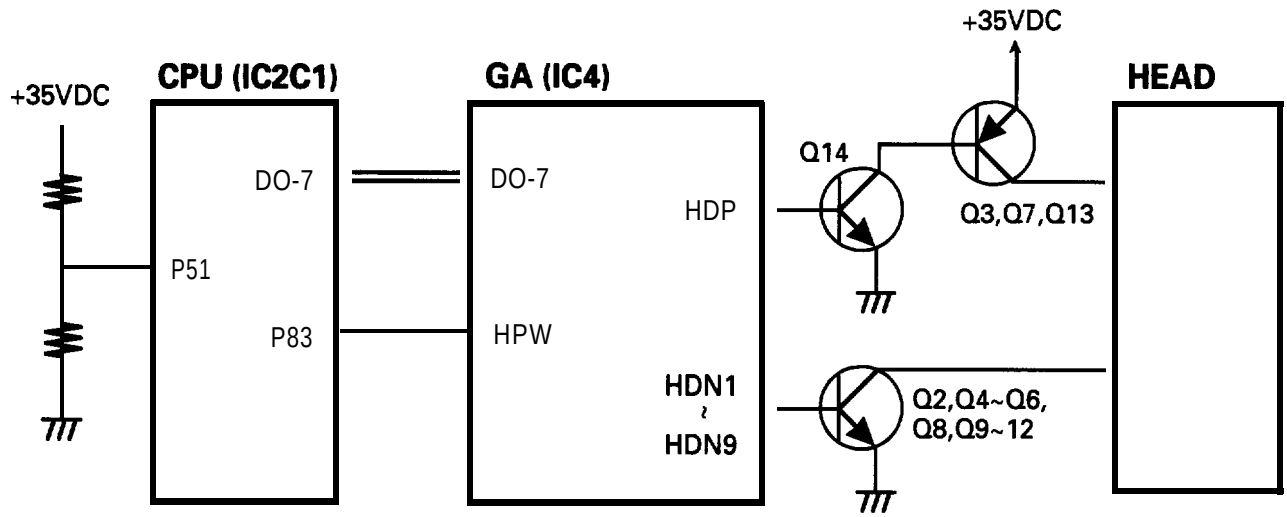


Figure 6-29. Printhead Drive Circuit

Parallel Interface Circuit

The parallel interface circuit controls the data flow from the host computer. When a $\overline{\text{STROBE}}$ signal is sent from the host computer, the data is latched into the gate array (E05A66YA). Data is transmitted until a BUSY signal is sent back automatically to the host computer to stop the data. Then, the gate array outputs an $\overline{\text{IBF}}$ signal to P82 (the interrupt signal port) of the CPU. The CPU then reads the data latched into the gate array and, on completion of the reading, resets the BUSY signal to enable the host computer to send more data. Figure 6-30 shows the parallel interface circuit.

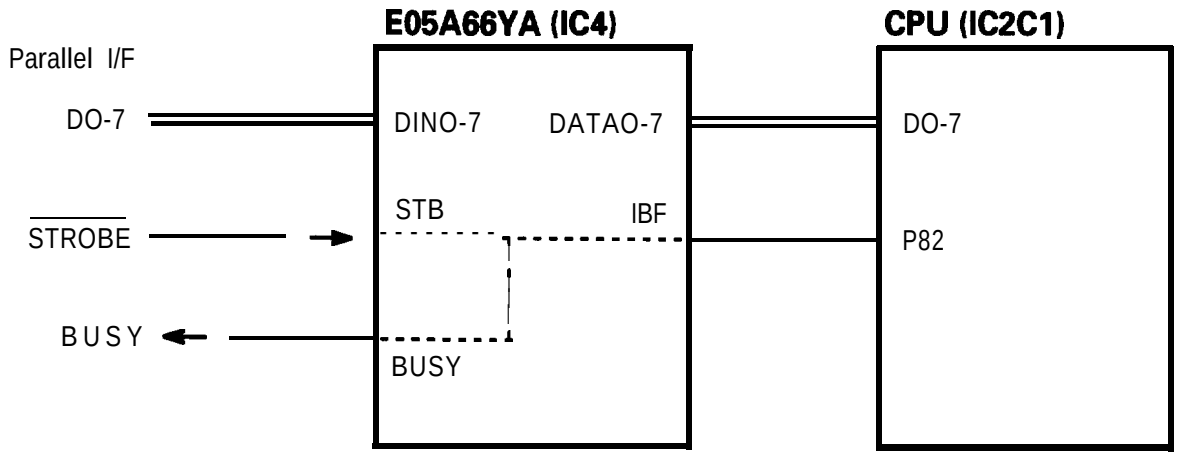


Figure 6-30. Parallel Interface Circuit

E²PROM Control Circuit

Figure 6-31 shows the E²PROM control circuit. The E²PROM is non-volatile memory containing information, such as the top-of-form position. Because the E²PROM is a serial I/O device, the gate array converts the parallel data (sent from the host computer) into serial data.

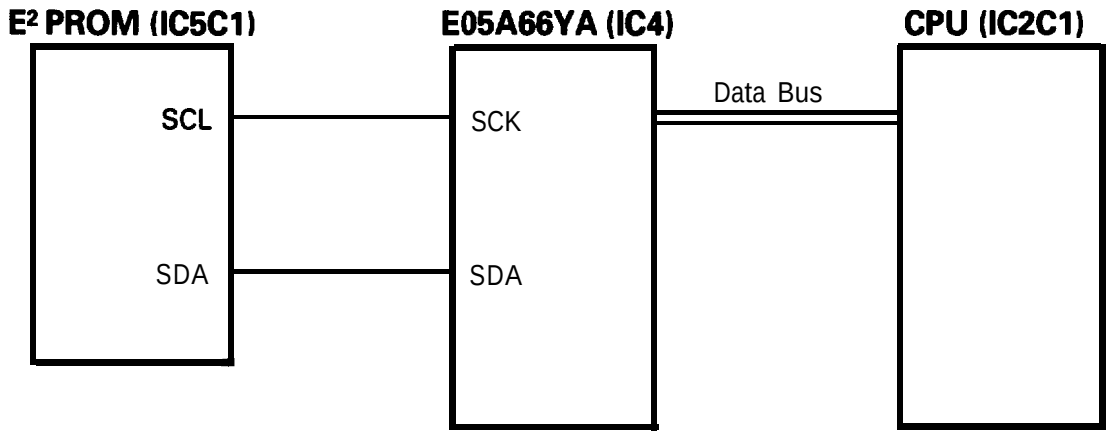


Figure 6-31. E²PROM Control Circuit

Component Repair Information (for Dealers Outside the U.S.)

This portion of the manual provides additional information for servicers outside the U.S. who need to make repairs to components on the circuit boards. (U.S. service technicians can ignore these pages.)

Repairing the C076 PSB Board Assembly

This section gives instructions for repairing the C076 PSB board assembly. It describes various problems, likely causes, checkpoints, and solutions. The checkpoint column provides proper waveforms, resistance values, and other information for each component of the C076 PSB.

WARNING

The OPERATE button on the control panel only turns the secondary power circuit on or off, so the primary power circuit is live as long as the printer is connected to an AC power outlet. Do not touch the heat sink attached to the FET (Ql) when the printer is powered.

Table 6-7. Repairing the C076 PSB Board Assembly

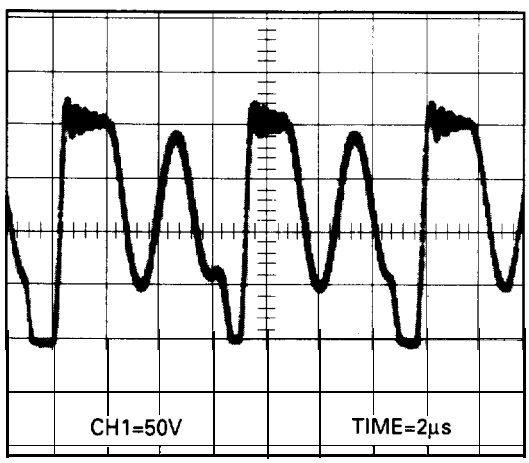
Problem	Cause	Checkpoint	Solution
The +35 V line is Sad.	Diode bridge DB1 i s b a d .	Measure the DC voltage between pins 3 and 4 of DB1.	Replace DB1.
	The transformer coils are open.	Measure the resistance of the T1 transformer coils at pins 3-2, 5-4, 1 O-l 1, and 11-9.	Replace T1.
	Q1 is bad.	` Check the voltage waveforms at Q1. 	Replace Q1.

Table 6-7. Repairing the C076 PSB Board Assembly (Continued)

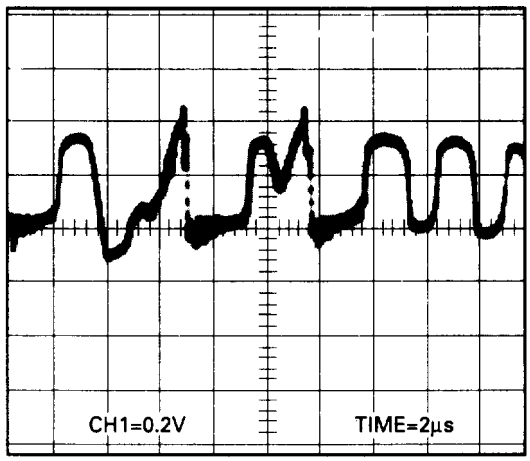
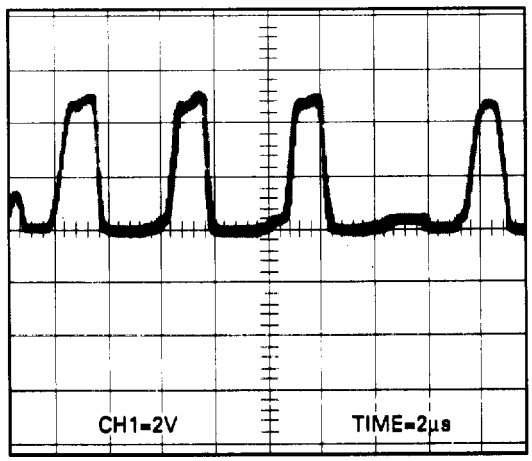
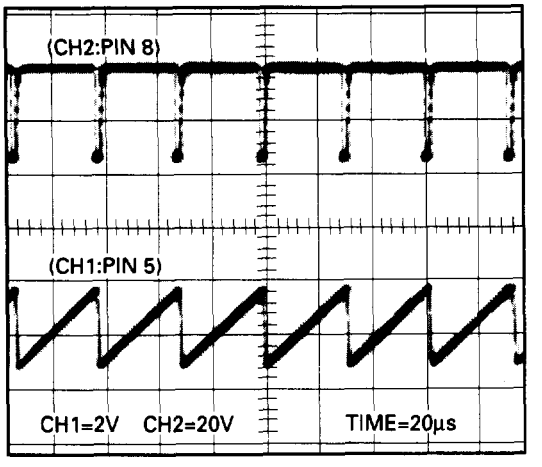
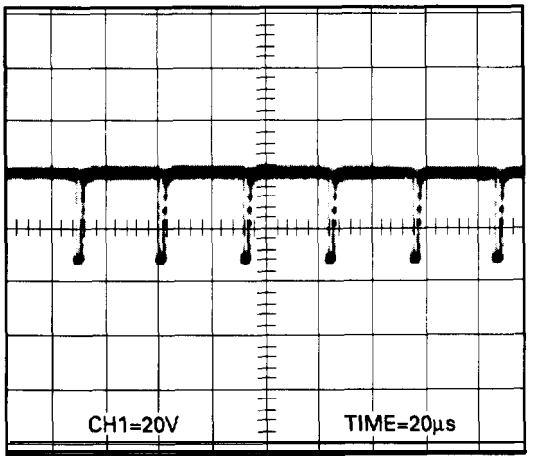
Problem	Cause	Checkpoint	Solution
The voltage of the t35 V line is below the specified value.	**Q3, IC1, PC1,** PC2 or **ZD51** is bad.	Check the voltage waveforms at Q3. 	Replace **Q3, IC1, PC1,** PC2 or **ZD51.**
	Q2 is bad.	Check the voltage waveforms at Q2. 	Replace **Q2.**

Table 6-7. Repairing the C076 PSB Board Assembly (Continued)

Problem	Cause	Checkpoint	Solution
he +5 V line is bad.	The +35 V line is bad.	Check the +35 V line.	Refer to the items described above.
	IC51 is bad.	Check the oscillation waveform (IC51 pin 5) and the switching waveform (IC51 pin 8). 	Replace IC51.
	Q51 or Q52 is bad.	Check the switching waveform at Q52 emitter. 	Replace Q51 or Q52.

Repairing the C094 MAIN Board Assembly

This section gives instructions for repairing the C094 MAIN board and describes various problems, symptoms, likely causes, checkpoints, and solutions. The checkpoint column shows proper waveforms, resistance values, and other information for each component of the C094 MAIN board.

Table 6-8. Repairing the C094 MAIN Board Assembly

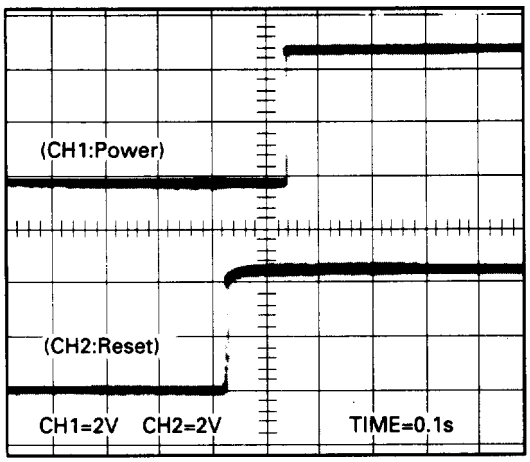
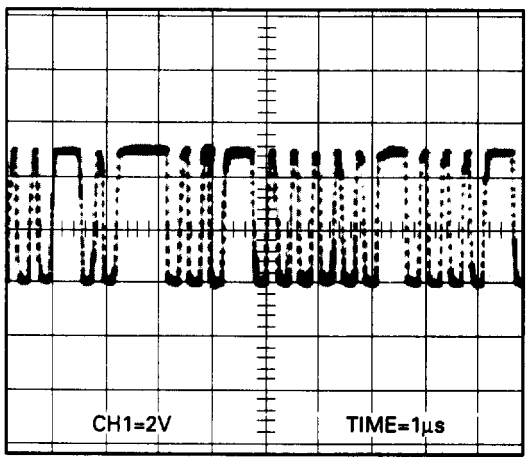
Problem	Symptom	Cause	Checkpoint	Solution
Abnormal operation at power on.	The CPU does not operate properly.	The reset circuit is defective.	Check the voltage waveforms of the VDD (+5 V) (IC4 pin 41) and ROUT (IC4 pin 15) when the power is turned on. 	Replace IC4
		The control ROM is not selected.	Check HIGH/LOW alternation for the signal (IC4 pin 4). 	Replace IC4.
		Either the ROM or the RAM is defective.		Replace IC2 or IC3.

Table 6-8. Repairing the C094 MAIN Board Assembly (Continued)

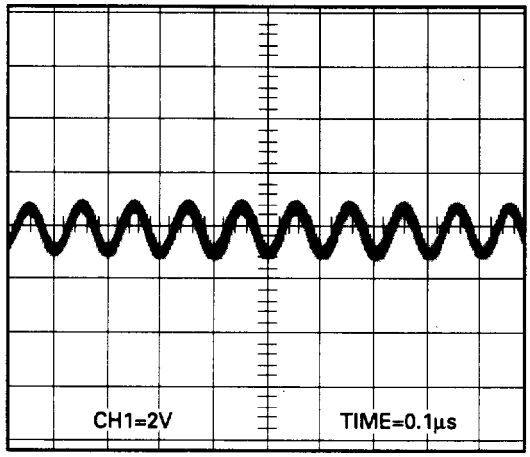
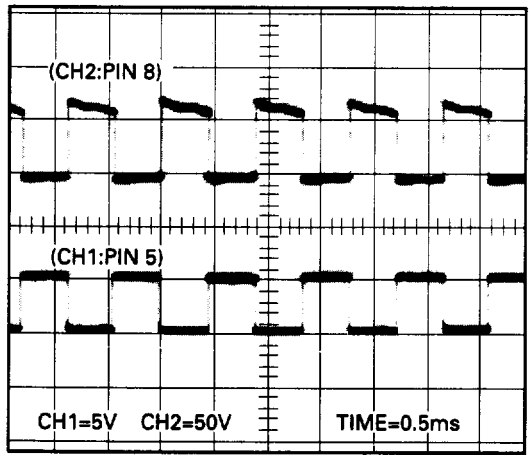
Problem	Symptom	Cause	Checkpoint	Solution
Abnormal operation at power on.	The CPU does not operate properly.	The CPU is defective.	Check the oscillator signal (IC2C1 pin 27 or pin 28).  	If the signal is not correct, replace IC2C1. Otherwise, replace CR1.
Carriage operation abnormal.	The carriage does not operate at all.	IC6 is defective.	Check the input signal (pin 5) and the output waveform (pin 8).  	Replace IC6.

Table 6-8. Repairing the C094 MAIN Board Assembly (Continued)

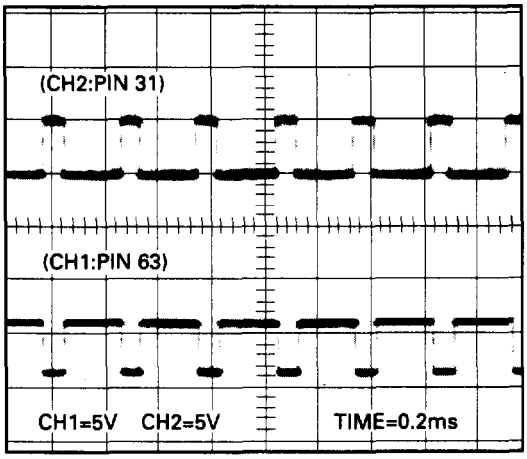
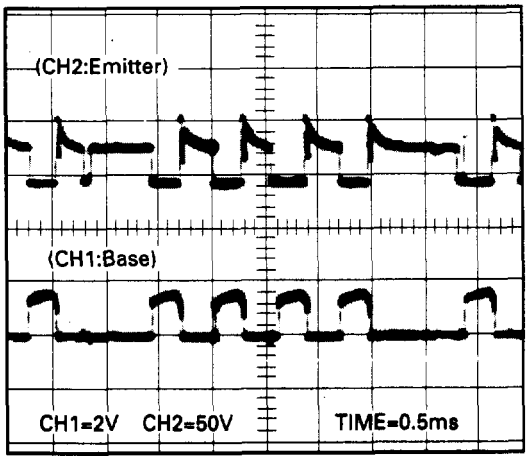
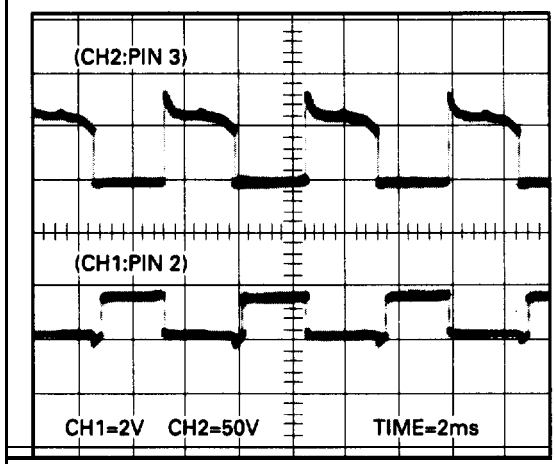
Problem	Symptom	Cause	Checkpoint	Solution
Self-test printing abnormal	The printer does not print the self-test.	IC4 is defective.	Check the head pulse signal at pin 31 (input) and pin 63 (output). 	Replace **IC4.**
Self-test printing abnormal.	A particular dot fails to print.	One of the head driie transistors is defective **(Q2, 4, 5,** 6, 8, 9, 10, 11, or 12).	Check the head drive signal at the base and the emitter of each transistor. 	If the signal at the base is normal, replace the transistor. Otherwise, replace **IC4.**

Table 6-8. Repairing the C094 MAIN Board Assembly (Continued)

Problem	Symptom	Cause	Checkpoint	Solution
Paper feed abnormal.	The printer does not feed the paper at all or the paper feed is irregular.	**IC1** is defective.	Check the input signal (pin 2) and the output waveform (pin 3). 	Replace **IC1**
Incorrect printing of data sent from the host computer.	Data is corrupted when the parallel interface is used.	Either IC4 or **IC5** is defective.		Replace **IC4** or **IC5.**

Chapter 7

Reference Materials

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List of Tables

Connector Summary

Figure 7-1 illustrates the interconnection of the primary components. Table 7-1 summarizes the functions and sizes of the connectors.

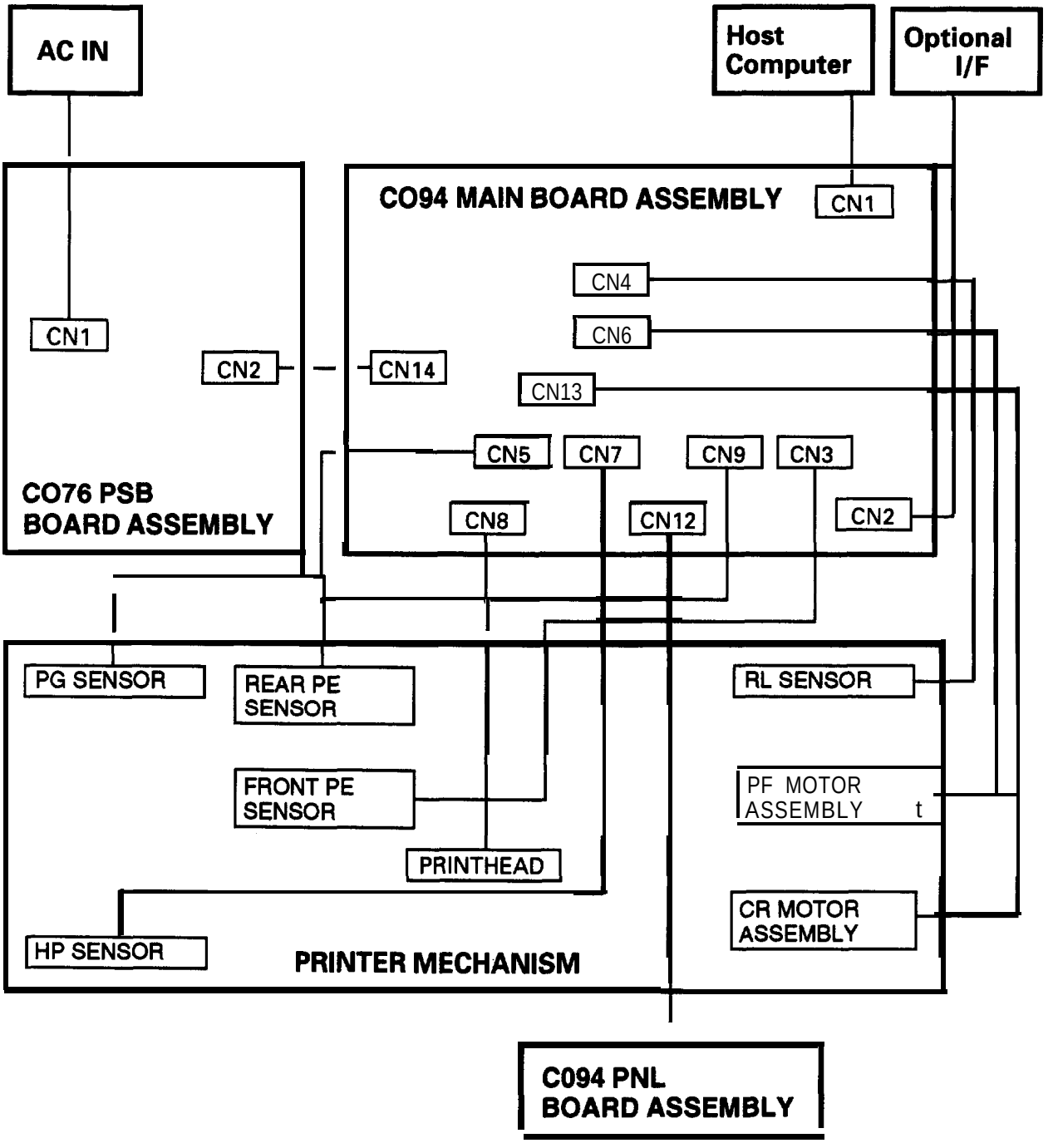


Figure 7-1. Cable Connections

Table 7-1. CO94 MAIN Board Connector Summary

Board	Connector	Function	Pins
CO94 MAIN Board Assembly	**CN1**	Host Computer	**36**
	CN2	Optional Interface	**36**
	CN3	Front PE Sensor	2 (Blue)
	CN4	Release (RL) Sensor	2 (White)
	CN5	Gap (PG) Sensor	2 (Black)
	CN6	PF Motor Assembly	6
	CN7	Home Position (HP) Sensor	2 (Yellow)
	CN8	Printhead	14
	CN9	Rear PE Sensor	3
	CN12	CO94 PNL Board Assembly	10
	CN13	CR Motor Assembly	5
	CN14	CO76 PSB Board Assembly	11

See Table 1-14 for **CN1** (Centronics interface) signal functions and pin assignments.

Table 7-2. CN2, Optional I/F (CO64 MAIN Hoard Assembly)

No.	I/O	Signal Name	Function
1		+5	+5 VDC
2		+5	+5 VDC
3		+5	+5 VDC
4	-	+5	+5 VDC
5	-	+5	+5 VDC
6	-	+5	+5 VDC
7	O	TXD	Transmit Data
8	O	READY	Ready to Receive Data
9	I	RXD	Receive Data
10	-	NC	No Connection
11	O	RST	Reset
12	O	INH	Inhibit
13	I	CMREQ	Command Request
14	I	WRRDY	Wriie Ready
15	I	RDREQ	Read Request
16	O	WR	Write
17	O	RD	Read
18	O	CS	Chip Select
19	-	GND	Signal Ground
20	-	GND	Signal Ground
21	-	GND	Signal Ground
22	-	GND	Signal Ground
23	-	GND	Signal Ground
24	-	GND	Signal Ground
25	O	A3	Address Bus Blt 3
26	O	A2	Address Bus Bit 2
27	O	AI	Address Bus Bit 1
28	O	A0	Address Bus Bit 0
29	I/O	D7	Data Bus Bit 7
30	I/O	D6	Data Bus Bit 6
31	I/O	D5	Data Bus Bit 5
32	I/O	D4	Data Bus Bit 4
33	I/O	D3	Data Bus Bit 3
34	I/O	D2	Data Bus Bit 2
35	I/O	D1	Data Bus Bit 1
36	I/O	DO	Data Bus Blt 0

Table 7-3. CN3, Front PE Sensor (CO94 MAIN Hoard Assembly)

No.	I/O	Signal Name	Function
1	-	GND	Signal Ground
2	I	PEF	Front Paper End

Table 7-4. CN4, Release Sensor (CO94 MAIN Hoard Assembly)

No.	I/O	Signal Name	Function
1	-	GND	Signal Ground
2	I	LSW	Release Lever Position

Table 7-5. CN5, PG Sensor (CO94 MAIN Hoard Assembly)

No.	I/O	Signal Name	Function
1	-	GND	Signal Ground
2	I	GSW	Platen Gap Adjust Lever

Table 7-6. CN6, Paper Feed Motor (CO64 MAIN Hoard Assembly)

IMO.	I/O	Signal Name	Function
1	O	PFA	PF Motor Phase A
2	O	PF $\overline{A}$	PF Motor Phase $\overline{A}$
3	O	PFB	PF Motor Phase B
4	O	PF $\overline{B}$	PF Motor Phase $\overline{B}$
5	O	PFCOM	PF Motor Common
6	O	PFCOM	PF Motor Common

Table 7-7. CN7, Home Position Sensor (CO64 MAIN Hoard Assembly)

No.	I/O	Signal Name	Function
1	-	GND	Signal Ground
2	I	HOME	CR Home Position

Table 7-8. CN8, Printhead (CO94 MAIN Board Assembly)

So.	I/O	Signal Name	Function
1	0	HD2	Head Data 2
2	0	c246	Head Drive Common
3	0	HD6	Head Data 6
4	0	HD8	Head Data 8
5	0	HD4	Head Data 4
6	0	HD9	Head Data 9
7	I	TMP	Head Temperature
8	0	c789	Head Drive Common
9	0	TMP	Head Temperature
10	0	HD1	Head Data 1
11	0	HD3	Head Data 3
12	0	HD5	Head Data 5
13	0	HD7	Head Data 7
14	0	C135	Head Driie Common

Table 7-9. CN9, Rear PE Sensor (CO94 MAIN Board Assembly)

INo.	I/O	Signal Name	Function
1	-	GND	Signal Ground
2	I	PER	Rear Paper End
3	I	LED	Paper End LED

Table 7-10. CN12, Control Panel (CO94 MAIN Board Assembly)

No.	I/O	Signal Name	Function
1	-	+5	+5 VDC
2	0	READY	READY LED
3	0	STAT	STAT LED
			(Not equipped)
4	0	FONT	FONT LED
5	0	COND	'CONDENSED LED
6	I	PAUSE	PAUSE Button
7	I	FONT	FONT Button
8	I	PFEED	PAPER FEED Button
9	I	OPERA	OPERATE Button
10	-	GND	Signal Ground

Table 7-11. CN13, Carriage Motor (CO94 MAIN Board Assembly)

No.	I/O	Signal Name	Functlon
1	O	CR A	CR Motor Phase A
2	0	CR $\overline{A}$	CR Motor Phase $\overline{A}$
3	0	CR $\overline{B}$	CR Motor Phase $\overline{B}$
4	0	CRB	CR Motor Phase B
5	0	CRCOM	CR Motor Common

Table 7-12. CN14, Power Supply (CO94 MAIN Board Assembly)

No.	I/O	Signal Name	Function
1	-	+5	+5 VDC
2	-	+5	+5 VDC
3	-	GND	Signal Ground
4	-	GND	Signal Ground
5	-	GND	Signal Ground
6	-	GP	Power Ground
7	-	GP	Power Ground
8	-	GP	Power Ground
9	-	+35	+35 VDC
10	-	+35	+35 VDC
11	-	PSC	Power Switch Signal

Circuit Diagrams

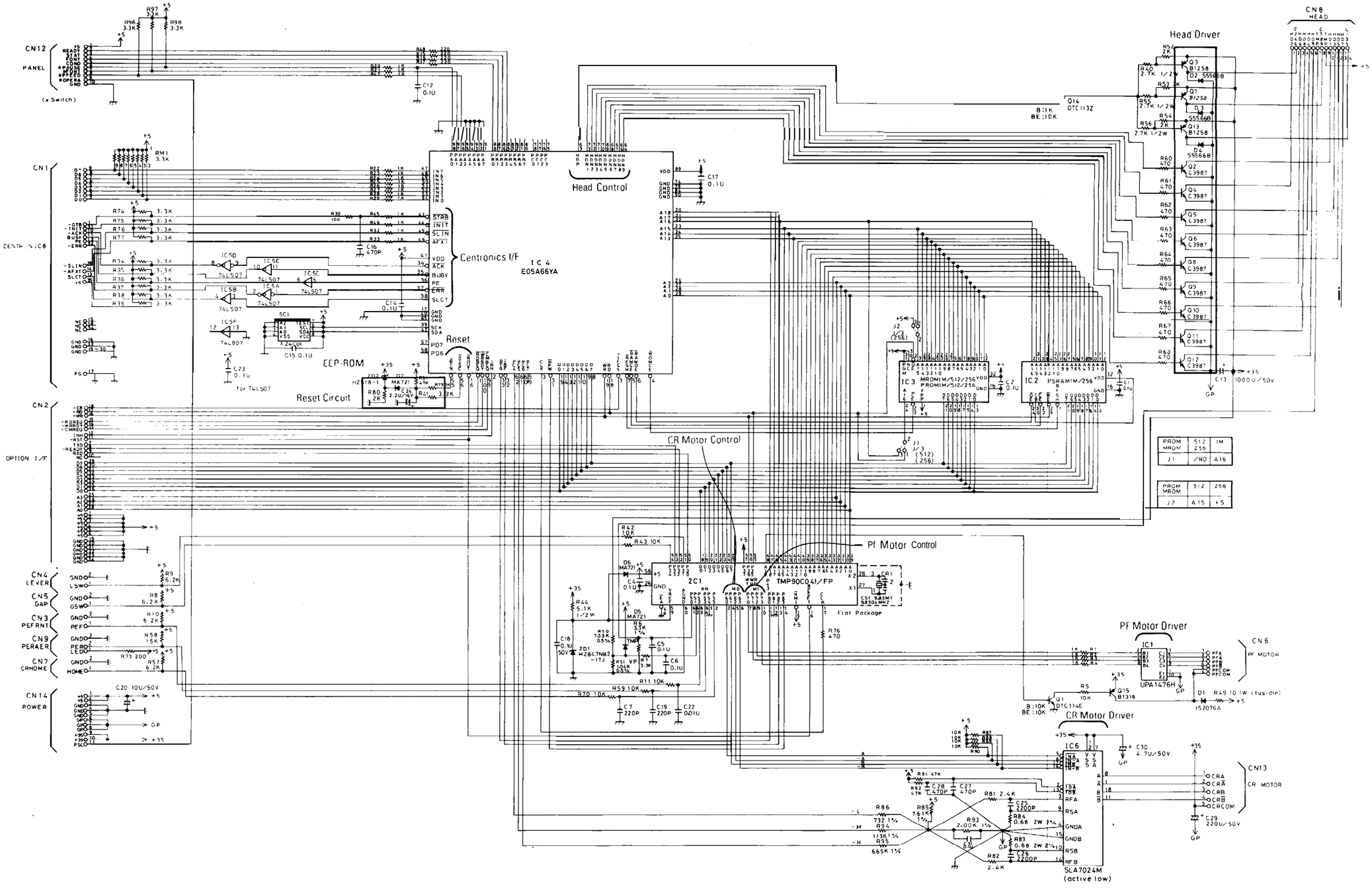
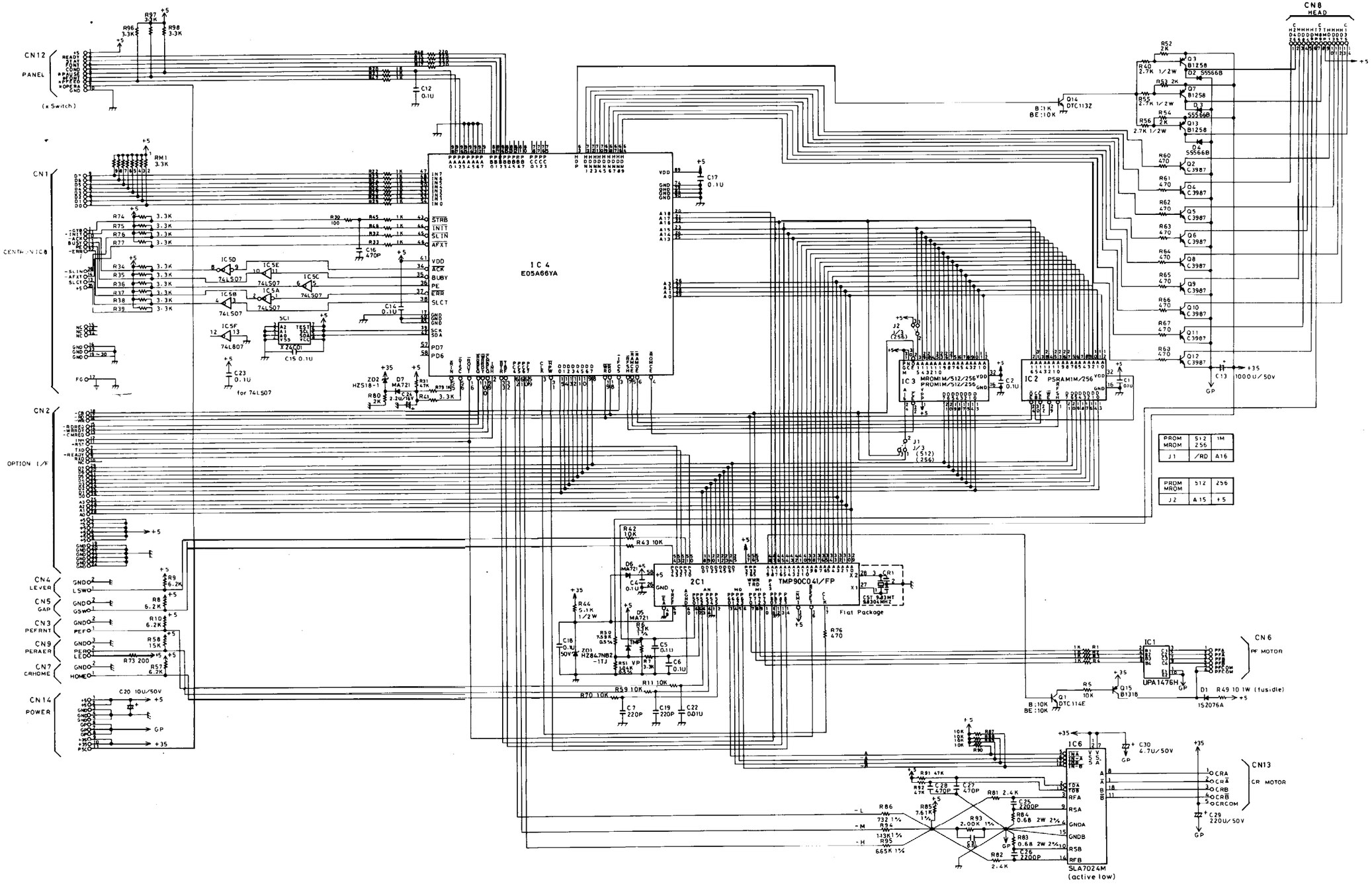
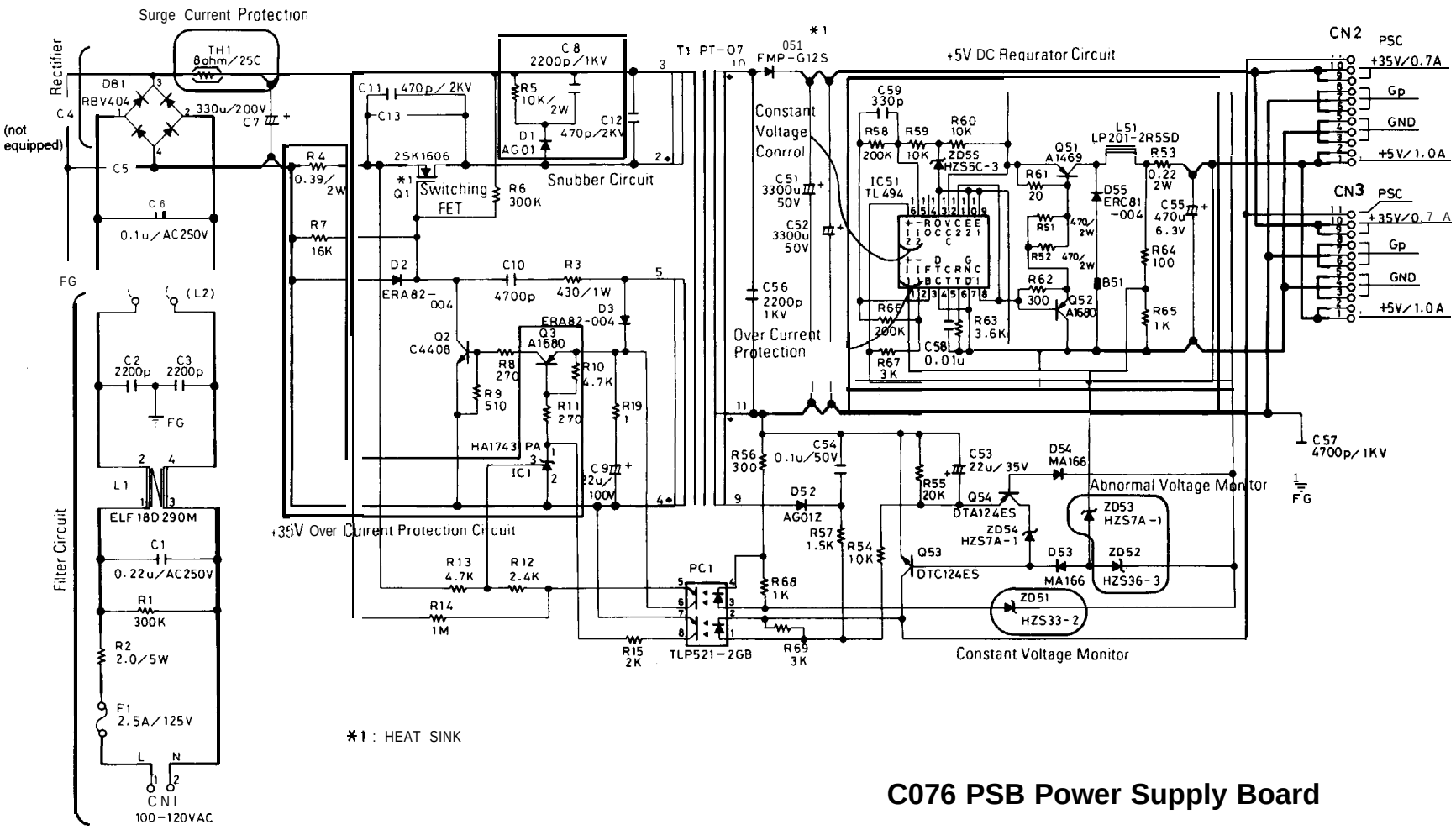


Figure 7-2. C094 MAIN Board Assembly Circuit Diagram (Annotated)


CN12
PANEL
(x Switch)
CN1
CENTRONICS
CN2
OPTION I/F
CN4
LEVER
CN5
GAP
CN3
PEFRNT
CN9
PERAER
CN7
CRHOME
CN14
POWER
CN8
HEAD
CN6
PF MOTOR
CN13
CR MOTOR
IC4
E05A66YA
2C1
TMP90C041/FP
Flat Package
IC3
MROM1M/512/256
PROM1M/512/256
IC2
PSRAM1M/256
IC1
UPA1476H
IC6
SLA7024M
(active low)
X24C01
74LS07
74L807
PROM MROM 512 256 1M
J1 /RD A16
PROM MROM 512 256
J2 A15 +5
C13 1000U/50V
C20 10U/50V
C29 220U/50V
C30 4.7U/50V
Figure 73. C094 MAIN Board Assembly Circuit Diagram



C076 PSB Power Supply Board

Figure 7-4. C076 PSB Board Assembly Circuit Diagram (Annotated)

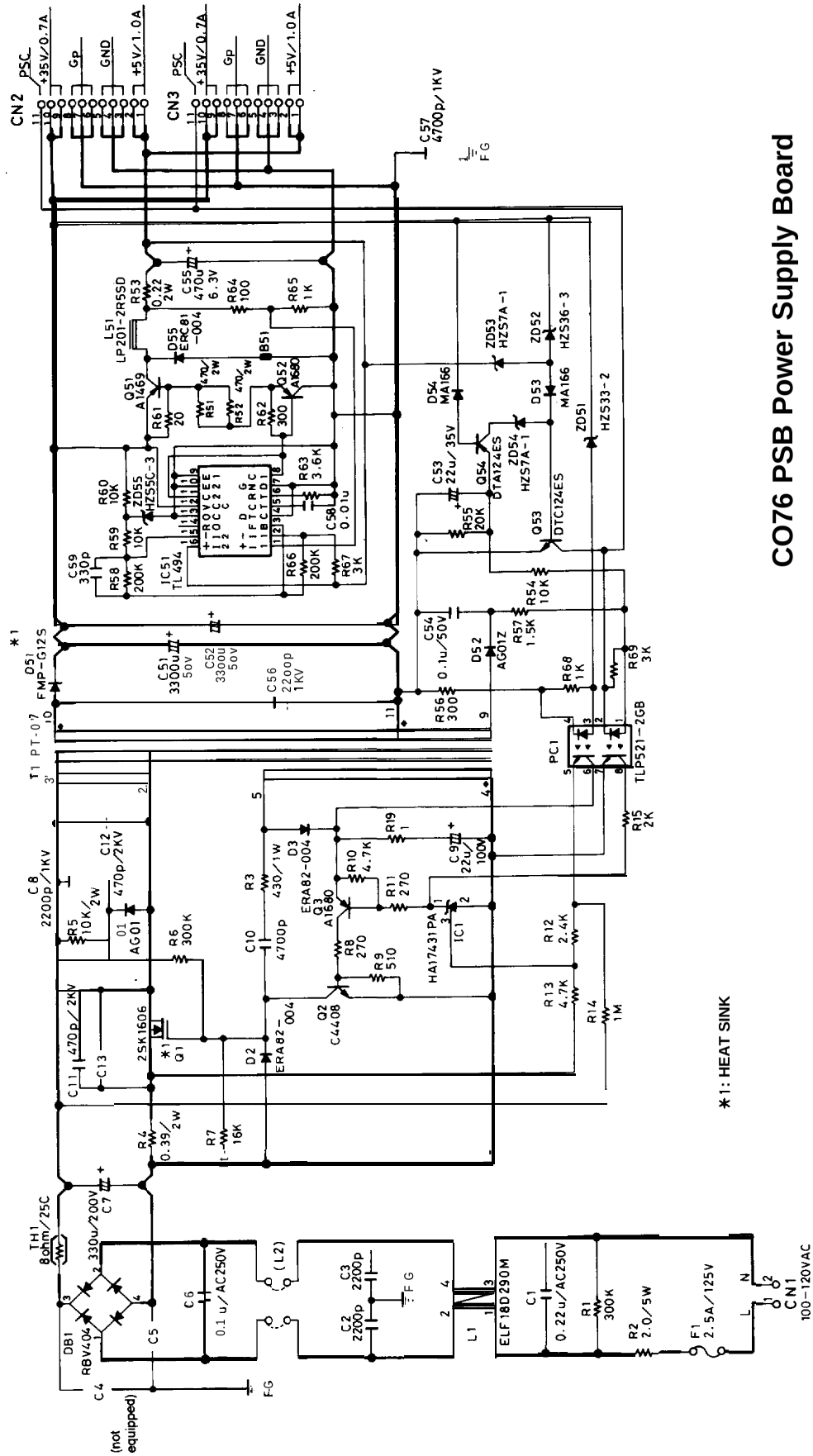
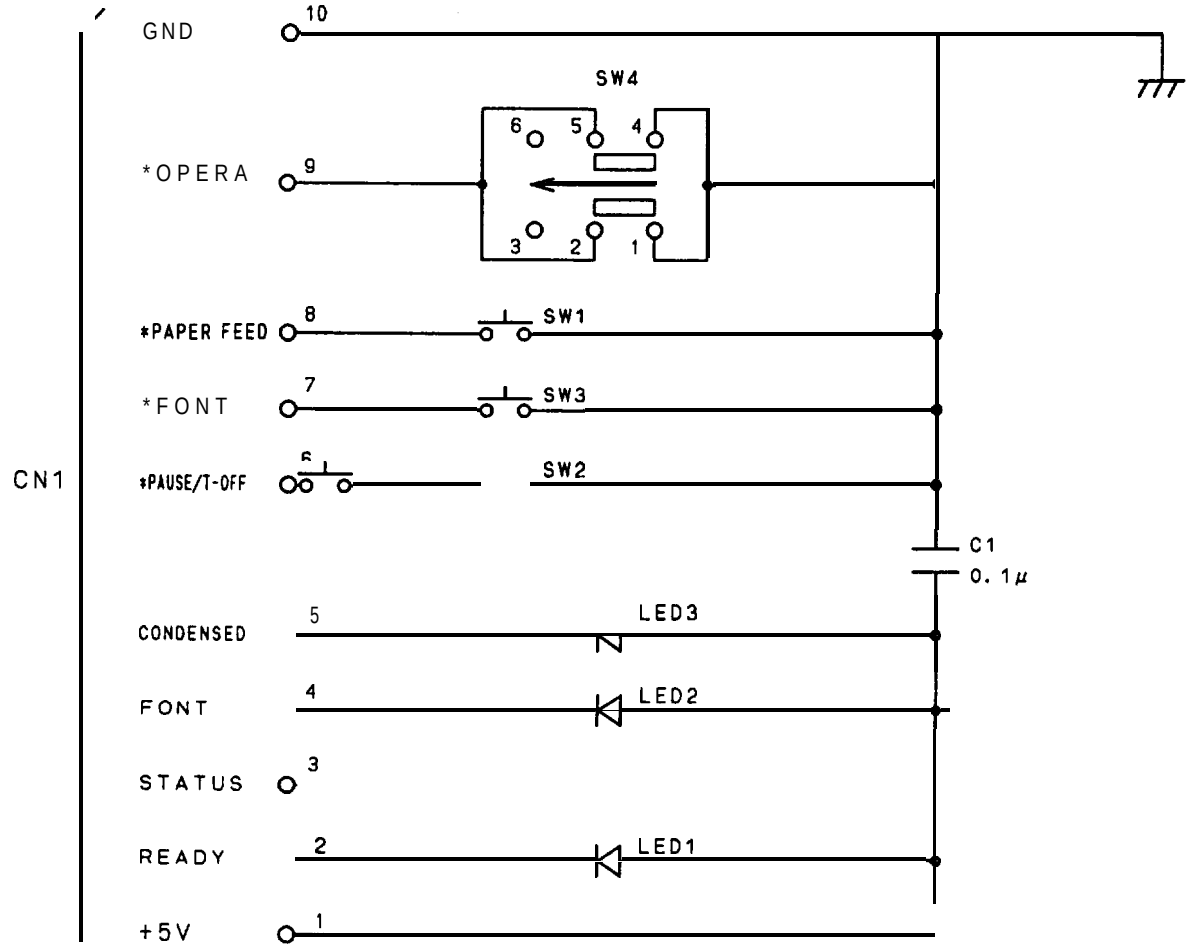


Figure 7-5. C076 PSB Board Assembly Circuit Diagram



Note: The STATUS LED is not implemented in this model.

Figure 7-6. C094 PNL Board Assembly Circuit Diagram

Circuit Board Component Layouts

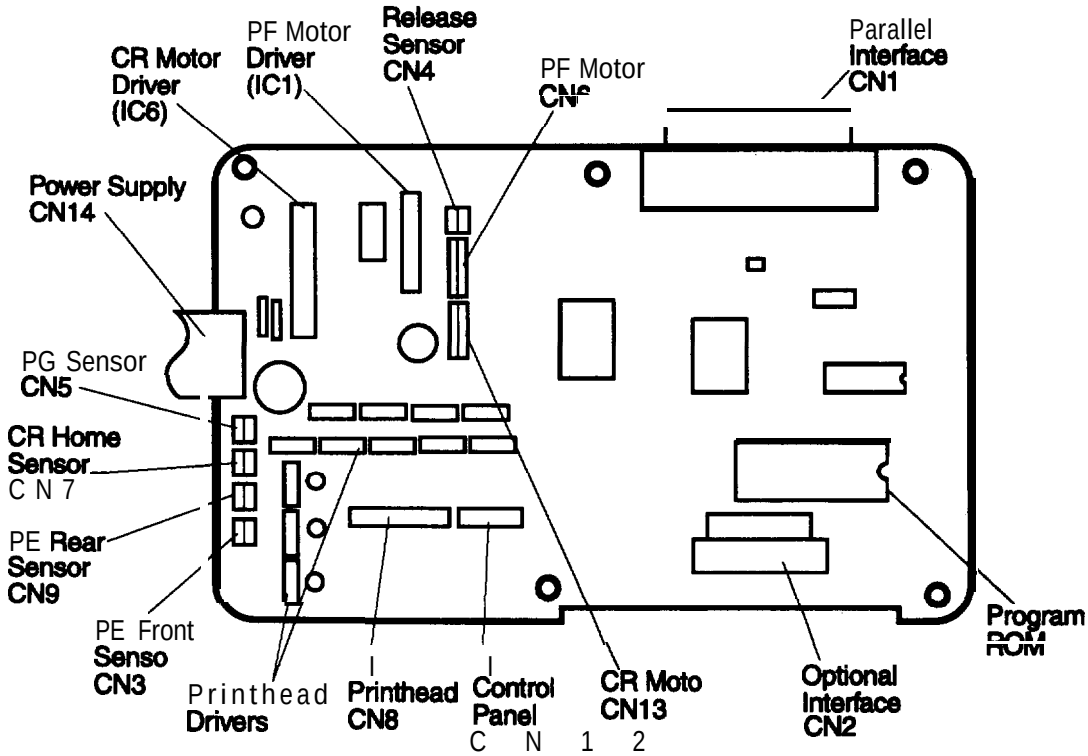


Figure 7-7. C094 MAIN Board Assembly Component Layout

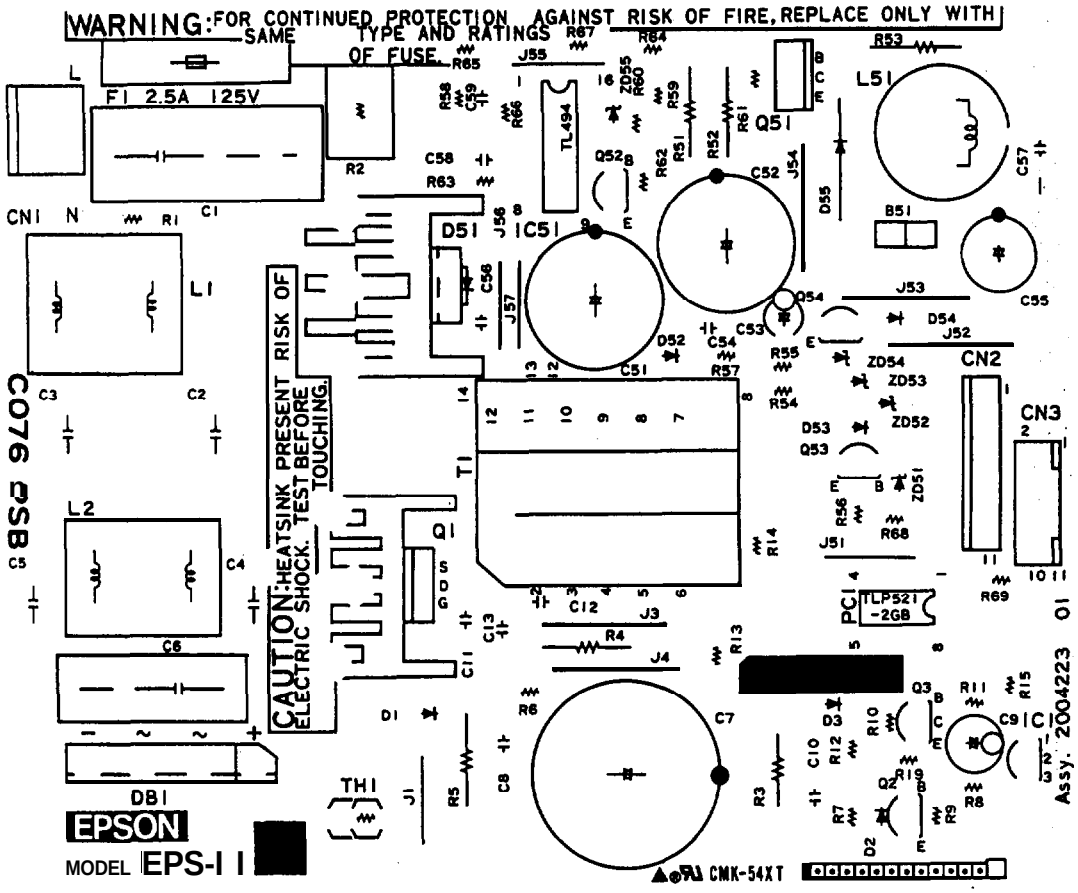
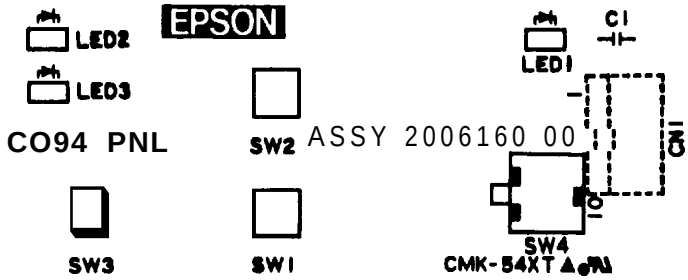


Figure 7-8. C076 PSB Board Assembly Component Layout



Note: The STATUS LED is not implemented in this model.

Figure 7-9. CO94 PNL Board Assembly Component Layout

Outline Drawings

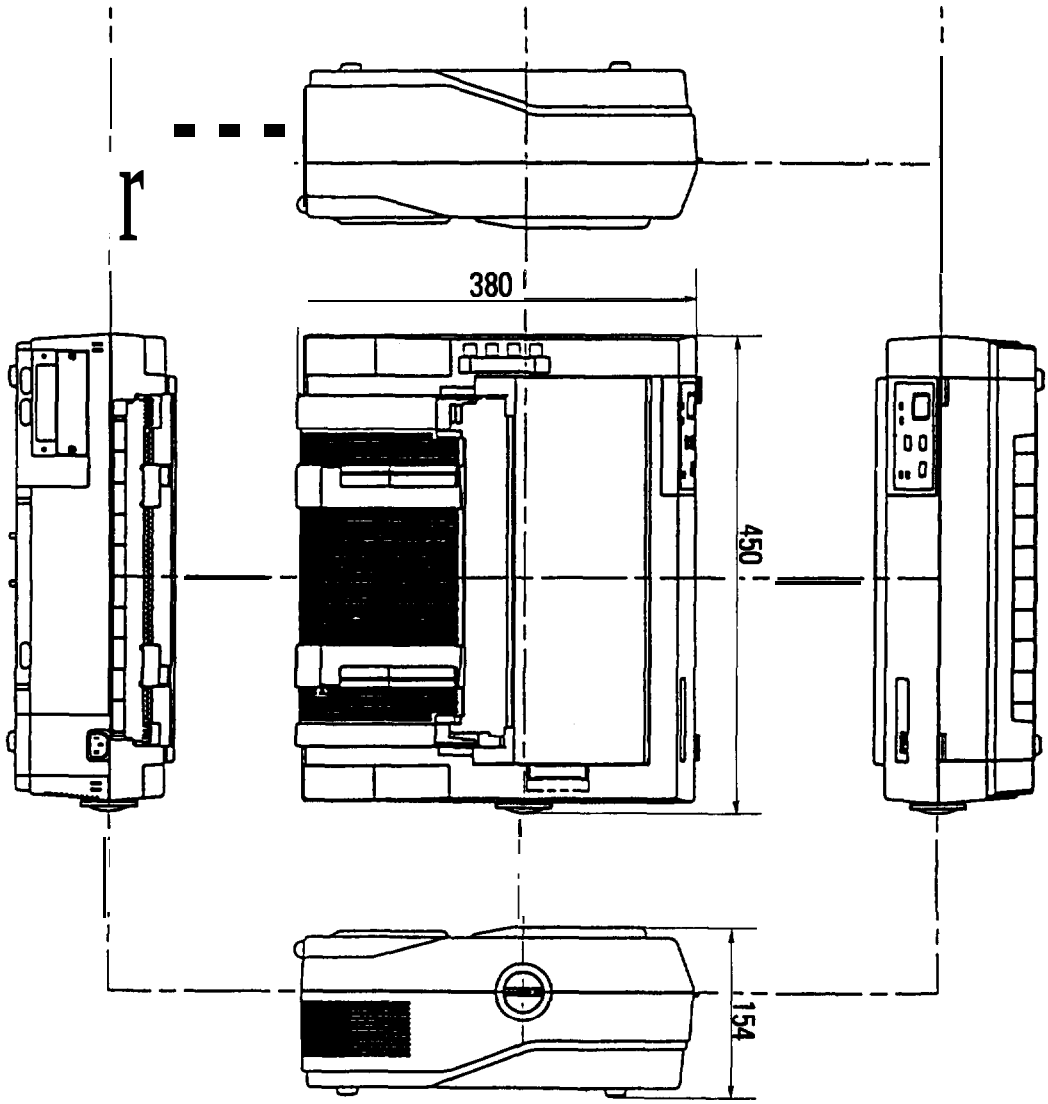


Figure 7-10. FX-870 Case Outline Drawing

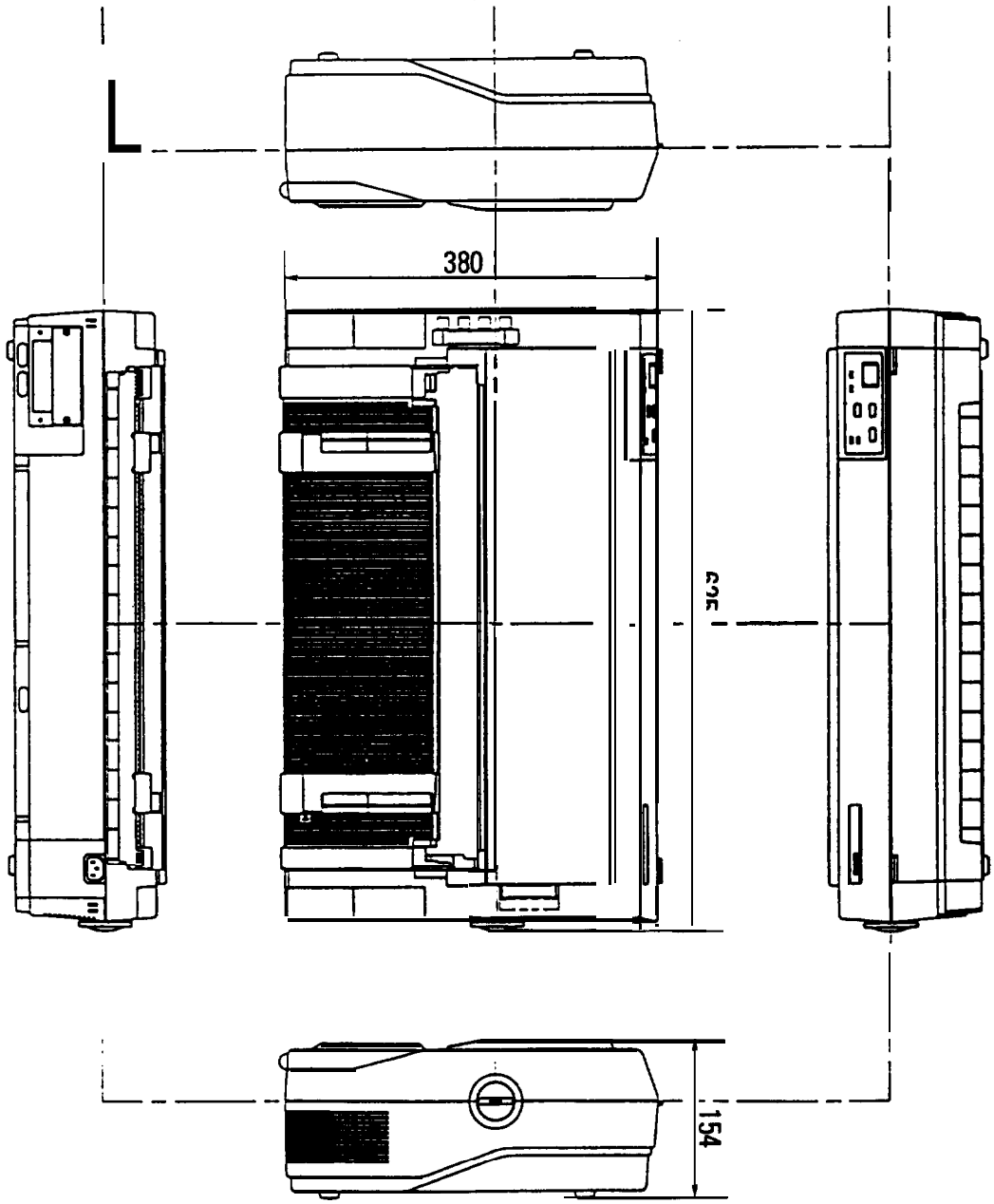


Figure 7-11. F'X-1170 Case Outline Drawing

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